COMPTON'S

PICTURED ENCYCLOPEDIA

AND

FACT-INDEX

INTERESTING · ACCURATE · UP-TO-DATE

To inspire ambition, to stimulate the imagination, to provide the inquiring mind with accurate information told in an interesting style, and thus lead into broader fields of knowledge—such is the purpose of this work

VOLUME 13

F. E. COMPTON & COMPANY · CHICAGO

1944 EDITION
COPYRIGHT 1944 BY
F. E. COMPTON & COMPANY

Printed in U. S. A.

Here and There in This Volume

AT ODD TIMES when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. With this as a guide, you may visit far-away countries and watch people at their work and play, meet famous persons of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list is not intended to serve as a table of contents, an index, or a study-guide. For these purposes consult the Fact-Index and the Reference-Outlines.

For the Reading and Picture Hour

Parent and Child; School and Home

High Lights in History's Pageant

Travel-Views of Lands Across the Seas

HERE AND THERE IN THIS VOLUME

In the Plant and Animal World

The Wonder We Call "Life"

Tours Through North and South America

Marvels of Science and Invention

Guide-Posts to Literature, Art, and Music

Rambles Through Factland

Interest-Questions Answered in This Volume

Of what animal do we eat only the muscle? 36.
What bird's nests are used as food? 333.
What animal may be said to walk on its ribs? 169.
Why did the fruit growers of California import the Australian lady-bug? 34.
What causes sound? 194.
What living trees are supposed to be over 3,500 years old? 80.
How is silver used in photography? 152.
Why do so many foods not "taste" right when you have a cold? 164.
What book written as a satire on human nature has become a children's classic? 342.
What English writer intended to reform the world but is remembered only for his poetry? 110.
Mention three of Saint-Gaudens' best statues. 7.
Schiller's plays greatly stimulated German patriotism. Explain why. 39.
What American novel helped to bring about a war? 304.
For what type of musical composition is Schubert especially noted? 41.
What is "relief" in sculpture and what is its opposite? 52.
Why did Shelley write the poem 'Adonais'? 110.
What fashion in literary composition did Sir Walter Scott set? 49.
Who owns and manages the Suez Canal? 318.
How do water spiders get air into their nests at the bottom of ponds? 256.
How do snakes hear? 173.
What familiar tree bears leaves of three different shapes? 31.
What fish are hatched out in a pouch in the body of the male parent? 67.
What animal spends nearly its whole life hanging upside down? 164.
Why is a bubble round? 178.
How many kinds of rattlesnakes are found in the United States? 171.
Where are the Bad Lands and how were they formed? 218.
How are wandering sand dunes kept at home? 22.
What river has "reversing falls" where the water may flow in either direction? 7.
What bean is used for plastics and paint as well as for food? 224.
Where is "the cold pole of the earth"? 136.
Why is the Sahara a desert? 4.
Where is ivory "mined"? 138.
How do we know that the Sahara was once the bottom of a sea? 5.
Would a sea-cucumber make a good vegetable salad? 67.
What were the seven wonders of the ancient world? 83 pictures.
Where is the world's longest railway tunnel? 349.
Why do swallows, unlike most birds, travel by day when migrating? 332.
What creatures construct "balloons" with which they make long journeys? 256.
Are sponges plants or animals? 260.
Why do sycamores shed their bark? 360.
Does the flying squirrel really fly? 266.
Why isn't spider silk used for making cloth? 257.
How does smoke cause fog? 166.
How do stones tell the progress of man? 293.
What ancient state had two kings at the same time? 239.
Why were Austria, Russia, and France referred to in the Seven Years' War as "the League of Three Petticoats"? 84.
What sea animal propels itself by sucking in and squirting out water? 35.
What is the physical difference between music and an unpleasant noise? 195.
How has science been able to tell what stars are made of? 241–2.
How has man changed the shape and character of sheep? 105.
Into how many languages has 'Uncle Tom's Cabin' been translated? 304.
What has the sun to do with the winds? 326.
Why is silver tarnished by egg? 323.
Why can't a snake close its eyes? 169.
Why is coal smoke darker than wood smoke? 165.
How do we know that some stars are "dead"? 272.
Traveling 150 miles an hour, how many years would it take you to reach the sun? 326.
What influence did Savonarola have on life in Florence? 33.
How did the Bowery get its name? 311.
How did Sir Isaac Newton find that white light is really a mixture of colored lights? 241.
Who guessed the riddle of the Sphinx? 249.
Describe briefly the social influence of the Salvation Army. 19.
What were the "Saturnalia"? 31.
How are spruces distinguished from pines and firs? 264.
From what fish do we get caviar and isinglass? 310.
How can people "talk" with flags and lights? 143.
What effect has the system of granting patents had on the organization of the shoe industry? 132.
For what change in the art of heating was Benjamin Franklin responsible? 304.
How many stars are believed to exist? 272.
Tell briefly how the spice trade has affected the course of history. 249.
How did people cleanse their bodies before the introduction of soap? 175.
Why are some soils "warm" and others "cold"? 191a.

Key to Pronunciation

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index. Marked letters are sounded as in the following words: *cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wȯn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;* *ü* = French *u*, German *ü*; *ġem, ḡo; thin, ~~th~~en;* *ṅ* = French nasal (*Jeaṅ*); *zh* = French *j* (*z* in *azure*); *ĸ* = German guttural *ch*.

S

SABBATH. It has been said that the Sabbath is "a festival not of one city or one country, but of all the earth." A weekly day of rest has been found among almost all nations, including the ancient Egyptians, Babylonians, Hindus, Persians, Greeks, and Romans.

It has been said that the Hebrews derived their Sabbath from the Babylonians, but as observed by the Hebrews it acquired a new significance. It was a day of rest (the Hebrew *shabath* means "to rest"), but it was also a holy day, a memorial of the completion of creation on the Seventh Day and of the deliverance of the Israelites from Egyptian bondage. The Hebrew Sabbath is the seventh day of the week (our Saturday) and it lasts from sunset on Friday to sunset on Saturday. During this time all labor must cease; according to the fourth commandment it was forbidden also to cause servants or animals to labor. Orthodox Jews still observe their Sabbath strictly.

Among Christians, the *first* day of the week, as the Lord's Day, the day of Christ's resurrection, early came to be regarded as more holy than the Hebrew Sabbath, and so Sunday came to supersede Saturday as a day of rest as well as a day of worship. The church transferred many features of the Jewish Sabbath to Sunday and designated that day as the Sabbath. However, there are some Christian sects which today observe the seventh day as their Sabbath. Mohammedans keep Friday as the day for special religious services, but they are not required to rest from their labors except during the time of the midday prayer. (*See* Day; Week.)

SACRAMENTO, CALIF. Camellia-wreathed Sacramento, with its gold-domed statehouse, is the political capital of the state and the "geographical pivot" and commercial capital of the great twin valleys—the Sacramento to the north and the San Joaquin to the south. It is one of the leading manufacturing cities of California, shipping immense quantities of flour and grist-mill and rice-mill products to China, Japan, and Australia.

The present site of Sacramento was included in New Helvetia, the 11 square leagues of land which Capt. John A. Sutter secured from the Mexican government in 1839. Sutter's Fort, the nucleus of the first California settlement of gold-seekers ten years later, is within the city limits; it is now restored and used as a museum. It was in January 1848 that gold was discovered in Sutter's millrace, some miles up the valley; and soon Sacramento was the roaring metropolis of the mining camps so well described by Bret Harte. In those days clipper ships from around the Horn used to sail into San Francisco Bay and up the Sacramento River to Sacramento; and the splendor and luxury of the floating palaces which plied between San Francisco and Sacramento in the "glorious '60's and '70's" is a dazzling memory. The greedy gold-seekers demoralized navigation up the Sacramento when they forsook the shovel for the speedier hydraulic monitor, flinging whole mountainsides into the river, reducing the channel from 13 to 6 feet in depth, and making the Sacramento, in proportion to the territory it drains, the wildest, most flood-ridden river in the United States.

Sacramento has survived the floods, the crippling of its water transportation, and the passing of the mines; for the great days of wheat succeeded those of gold, and the Central Pacific Railroad reached the city by 1868. For a brief time the valley of the "Nile of the West" seemed destined to be, with the San Joaquin, the nation's granary. But the patient soil, never irrigated, never fertilized, never rested, at last rebelled; yields dropped from 45 bushels an acre to 13 and 8, and the reign of wheat was over. This checkered past explains the slow growth of a city of such tremendous potentialities.

With the breaking up of the vast grain ranches and the introduction of irrigation, a new era has dawned. The 20 counties of the Sacramento area grow two-fifths of the state's agricultural products, and the city has become an important center for canned fruits and vegetables, nuts, dairy products, flour, bakery products, rice, and meats. Other manufactures are lumber, pottery, brick, cement, automobile bodies and parts, and iron and steel products. The main shops of the Southern Pacific and Western Pacific railroads are here, employing thousands of operatives. Transportation is provided by these two transcontinental railroads and also by the Sacramento River, which carries an immense volume of freight. Millions of dollars have been spent to restore the navigability of the river, to control floods, and reclaim flooded lands. The city is handsomely built, with many fine public edifices, including the state library which specializes in law and in California history, the Crocker Art Gallery, a city auditorium, and a stadium. The city adopted council-manager government in 1921. Population (1940 census), 105,958.

SAFETY—*A Challenge to* COMMON SENSE *and* SKILL

Symbolic of the safety movement is the school safety patrol in his white belt and chest band. With arms outstretched, he holds back his schoolmates until the street is clear. Children have learned to accept his authority without question.

SAFETY. There is a foolish old saying, "Accidents will happen." Few accidents "happen"; most of them are the result of ignorance, carelessness, or lack of skill.

Babies do not fall out of windows if the windows are stoutly screened or barred. Skilful drivers and expert swimmers rarely have accidents. Few of the victims of electric shock are persons who have studied electricity and learned how to handle electrical appliances. Few workers get seriously hurt in factories where proper safety devices have been installed and where there has been a program of safety education.

We know beyond doubt that a large proportion of accidents can be prevented. Industrial plants which have intensive safety programs have cut their accident rate as much as 68 per cent in a 12-year period. In the 16 years after 1922, when safety education in the schools was started on a national scale, the accidental death rate for children of elementary school age was reduced by 32 per cent, although motor vehicles became twice as numerous.

The Appalling Cost of Accidents

But despite all that has been done, accidents still claim between 90,000 and 100,000 lives every year in the United States—almost twice as many lives as were lost in action by American forces in 1917–18 in the World War of 1914–1918. Besides this frightful death toll, 9 or 10 million persons are seriously injured every year. This is more than the population of New York City and Philadelphia combined.

No one can estimate the loss in social values that these deaths cause the nation—how family life is broken, or what contributions to science and culture are lost. But reckoned in terms of money, the loss of income resulting from these deaths is a huge amount. When this is added to the cost of injuries caused by accidents—in wages lost by persons too severely hurt to work and in the expense of medical care—the total amount is estimated at more than 2 billion dollars a year. Add to this a billion and a half dollars for property loss caused by automobile accidents and fires, and we get a total accident bill to the American nation of about $3,500,000,000 a year. This loss represents an amount equal to $100 for each family.

Careless Americans

The United States usually has more accidental deaths in proportion to population than any other country. This is largely because the United States has more automobiles, railroads, electrical appliances, and other machines than any other country, thus increasing the risk brought by the use of machines.

How can we prevent accidents? First, we can make our surroundings safer. We can reduce hazards in our homes, where one-third of all accidents happen. We

SIGNIFICANT FACTS AND TRENDS SHOWN IN GRAPHS

FIG. 1 CAUSES OF ACCIDENTAL DEATHS

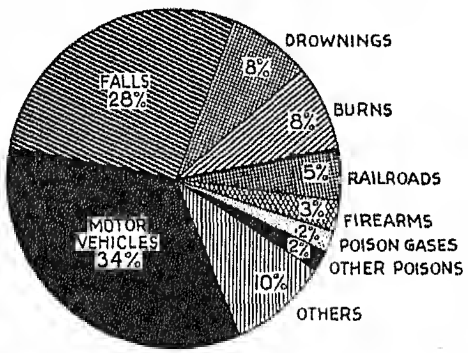


FIG. 2 WHERE CHILDREN GET HURT

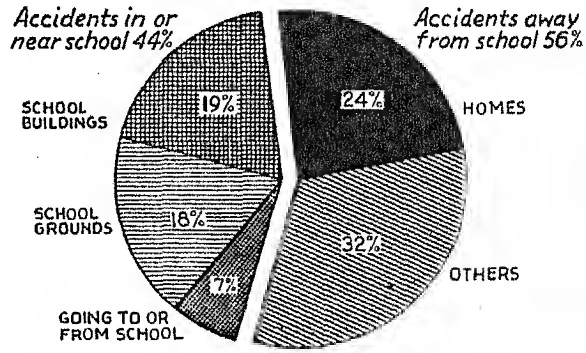
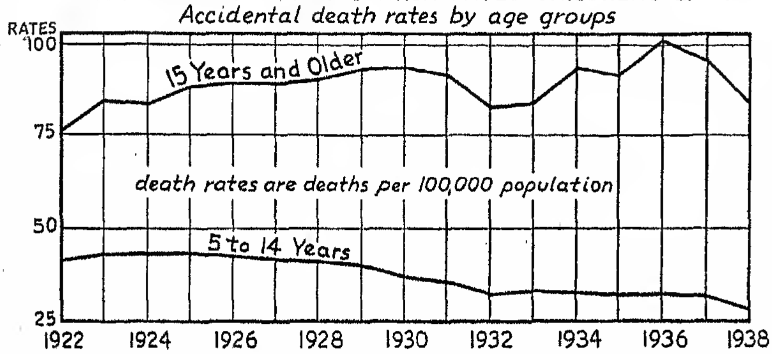


FIG. 3 HOW SAFETY EDUCATION SAVES CHILDREN'S LIVES
Accidental death rates by age groups



Motor vehicles and falls cause about two-thirds of the accidental deaths in the United States. This is shown in the first graph, which is based on statistics for a recent year. Fig. 2 tells us that in the same year children were safer in school or on their way to and from school than they were in other places. Nearly a quarter of all the accidents to children occurred at home. The small percentage of accidents to children going to or from school indicates the success of the campaign to protect children from traffic accidents near schools. Fig. 3 is inspiring testimony to the fruits of safety education in the schools since its beginning on a nation-wide scale in 1922. While the accidental death rate for the rest of the population has increased, the rate for children of elementary school age has been steadily dropping. (Data from the National Safety Council.)

can reduce hazards in public buildings, streets, transportation agencies, factories, and mines. Second, we can all develop "safety alertness," by following the rules laid down later in this article.

Growth of the Safety Movement

The first work in accident prevention was undertaken by industry. This grew out of the horrifying number of accidents that followed the introduction of machinery in the 18th and 19th centuries (*see* Industrial Revolution). Beginning about 1867, many employers in Europe formed accident prevention associations, and installed devices to make machinery safer. Soon afterwards, beginning in England in 1880 with the Employers' Liability Act, laws were passed permitting disabled workers to sue for damages. These were followed by "workmen's compensation acts," which forced employers to carry insurance for injuries. Similar compensation laws were passed in the United States, beginning with Maryland's law in 1902. (*See* Employers' Liability.)

In the United States the next great forward steps were taken in 1907, when the Association of Iron and Steel Electrical Engineers began to promote safety work, and in 1913, when the National Safety Council was organized. The Council is a coöperative association which analyzes accident causes and promotes safety education. Among the organizations that belong to the Council are local safety councils, automobile clubs, schools, industrial associations, chambers of commerce; departments of federal, state, and city governments; and manufacturing, public utility, insurance, and transportation companies.

The Schools and Safety Education

Since the start of safety education on a national scale in 1922, many thousands of children have been saved from accidental death. In that year one out of every eight persons killed by accident in the United States was a child of between 5 and 14. Now, children of this age group contribute on the average only about one-fourteenth of the total—a lower accidental death rate than that of any other age group. In some cities that have stressed safety education and safety measures, child motor-vehicle fatalities have been reduced by 75 per cent.

In alarming contrast to this record for the younger children is the large increase since 1922 in the traffic accident death rate for the group which includes youths of senior high school and college age—between 15 and 24. In the hope of reducing the accident rate in this group, safety education is being extended into high schools and some colleges and universities. Many high schools are now giving courses in driver education and driver training.

Public Measures to Make Driving Safer

Nation-wide improvement of highways and of traffic regulation has helped to make driving safer. In 1924

Herbert Hoover, then secretary of commerce, called the first National Conference on Street and Highway Safety. Since that time, the national motor-vehicle death rate (based on mileage) has dropped about one-fourth. Some states have cut their rates by one-third, and some cities by as much as two-thirds.

Engineers make traffic surveys, widen highways, straighten curves, put up warning signs at danger spots, and build safety intersections, such as the "clover-leaf" pass. At railway intersections, underpasses or overpasses are built when possible. Other safety measures include stop-and-go lights, one-way streets, stop streets, safety islands, low speed in business and school areas, and special rules for heavy trucks. (*See* Automobiles.)

Many cities have police safety squads, which devise new prevention measures by scientific study of accident causes. Some cities compel traffic violators to attend "safety schools" directed by the police. To reduce danger from cars in poor mechanical condition, a growing number of cities require tests for brakes, lights, and other equipment. Cars and tires now are built so soundly that mechanical failure is rare except through misuse or neglect.

Educating and Testing Drivers

Thousands of organizations are helping to educate the public. Newspapers call attention to traffic hazards and print driving lessons. Magazines and radio programs warn drivers and pedestrians of carelessness. Insurance companies, gasoline distributors, and automobile clubs promote safe driving by booklets, advertisements, posters, and emblems mounted on cars. Through the Automotive Safety Foundation, established in 1937, the automobile industry contributes hundreds of thousands of dollars a year to schools and organizations for safety training. Parent-teacher associations are especially active in promoting safety education in the schools. The Red Cross, the Boy Scouts, the Girl Scouts, and the Camp Fire Girls also do a great amount of educational work.

Despite these efforts, traffic accidents are in most years the largest single cause of accidental deaths. The yearly toll is about one-third of all fatalities. By far the greater number of these accidents can be prevented by safety education, as is proved by the remarkable records of trained commercial drivers. Safety-trained truck drivers cut their accident death rate 29 per cent and motor bus drivers reduced theirs 41 per cent in the same ten-year period that private drivers increased theirs by 21 per cent. Hence many states require drivers to pass an examination in driving skill and physical fitness to obtain a license to drive. Some states with such restrictions have reduced their automobile death rate by as much as 35 per cent in a few years.

TESTING A DRIVER FOR HER REACTIONS TO EMERGENCIES

How fast can you apply the brakes in an emergency? How accurately do you estimate the speed and distance of an oncoming car? Are you excitable? These and other factors that mark the safe driver can be tested by the apparatus shown above. It was devised by the Bureau for Street Traffic Research of Harvard University.

Another promising approach to the traffic accident problem arises from the discovery that there is an "accident-prone" group of drivers who have far more than their share of mishaps. It is hoped that by suitable tests such dangerous drivers may be revealed before they have accidents rather than after.

How the Federal Government Promotes Safety

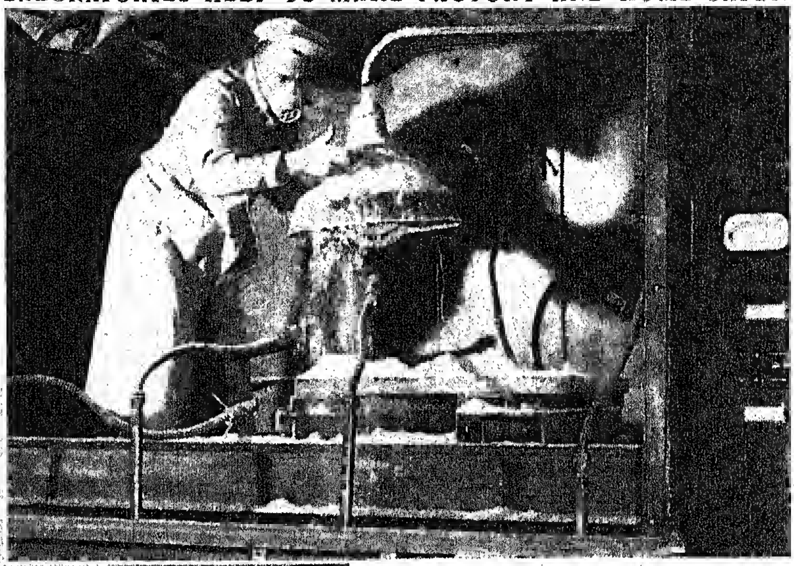
The Federal government does a great deal of safety work. The Interstate Commerce Commission, through its Bureau of Safety, inspects railroad safety appliances, such as brakes, couplers, and signal blocks. The commission also has authority over interstate motor bus and truck lines. Air transport safety is supervised by the Civil Aeronautics Board, which examines pilots, inspects planes, and conducts studies in accident prevention. Ships must be approved by the Bureau of Marine Navigation and Inspection, and seamen must meet requirements authorized by Congress. Waterways are supervised by the Coast Guard, which maintains lighthouses and other aids to navigation, and patrols the North Atlantic to reduce hazards from icebergs. The Coast and Geodetic Survey charts navigable waters and provides other information for the safety of mariners. Weather information

for ships, railroads, airlines, and other transportation agencies is supplied by the Weather Bureau. Safe highway engineering is promoted by the Public Roads Administration.

The Forest Service keeps an army of men at work to prevent and check forest fires. Under the direction of the War Department, a vast flood-prevention program protects life and property from the Mississippi and other rivers. From the Office of Education, safety literature and radio programs are sent to the nation's schools. Statistics compiled by the Bureau of the Census on the causes of accidental deaths are important sources of information.

Industrial safety is promoted by the Bureau of Labor Statistics. This bureau studies causes of accidents and recommends preventive measures, such as rest periods for workers, better lighting conditions, and protection of dangerous machines. Accidents in mining, one of the most hazardous industries, have been considerably reduced by the Bureau of Mines. At its experimental stations, the bureau conducts research in safer methods of mining and quarrying. It teaches miners how to render first aid and its especially trained "mine rescue" crews are rushed to mine disasters. Danger from dust explosions in mines, grain elevators, and other places has been reduced by research in the Bureau of Chemistry and Soils. Safety of materials and design is advanced by the National Bureau of Standards, which does a vast amount of research, such as testing materials for strength and for fire resistance, setting specifications for electrical equipment, and developing higher standards for building construction. This branch of the Department of Commerce is managed by distinguished scientists.

LABORATORIES HELP TO MAKE FACTORY AND HOME SAFER



The Federal Bureau of Standards and the Underwriters' Laboratories, which is sponsored by the National Board of Fire Underwriters, test building materials and appliances. Above, an investigator is testing electrical equipment for defects which might cause dust explosions. At left, the safety release on a washing-machine wringer is being checked.

State and Municipal Safety Measures

Each state has its own laws on safety, which are increasing yearly. These are administered by such state agencies as the department of labor, fire marshal, police, industrial commission, division of factory inspection, bureau of mines, highway commission, and commerce commission. Some laws require fireproof material in certain types of building. Others govern installation and operation of machinery, requiring, for example, automatic engine stops and shields or guards for all moving parts that may maim workers.

Many states enforce national *safety codes*. These codes are rules drawn for various industries by the American Standards Association, with the coöperation of the National Safety Council, and by other similar agencies. Under them, employers must provide proper lighting and ventilation, safety education for workers, and special equipment for dangerous work. Such equipment includes safety helmets for miners, tunnel drillers, and steel workers, and shatter-proof goggles for metalworkers and woodworkers.

Cities protect the safety of their people in nearly every activity of daily life. Fire departments by their prompt work save countless lives, and they prevent fires by inspecting buildings and neighborhoods for fire hazards. In recent years police departments have vastly increased their services in safeguarding

life, especially by equipping patrol cars and motorcycles with radios and by installing other scientific aids. Building departments inspect elevators, stairways, boilers, and other structural hazards. Water mains, sewer pipes, sidewalks, and streets are kept in repair by other municipal agencies. Cities are increasing their lighting facilities, since good street lighting is an aid to traffic safety and a deterrent to crime. To centralize these manifold activities, many cities have established safety commissions directed by safety engineers.

Growth and Value of Safety Engineering

Safety engineering is a relatively new profession, but it is taught at several universities, and foundations have been established to extend it. Originally it was concerned chiefly with industrial safety, training engineers to develop safety devices for machines and safe methods of operation. The profession has now grown to include traffic and community safety, and such training is given to the police departments of many cities.

Safety engineers are also employed by industrial companies, for industry has learned that safety means profit. Accident prevention in factories saves the time of both workers and machines, and hence increases production. It also brings lower insurance rates. Mechanical hazards have been so reduced that today machinery is involved in only some 12 per cent of industrial accidents. The development of automatic safety devices is an important factor. Some devices stop machinery the instant it reaches a dangerous speed. Others halt falling elevators, blow away poisonous fumes, or quench fires. Railroad accidents are prevented by automatic signal blocks and by air brakes. Transport planes glide to safe landings through use of the radio beam and other aids.

With seven-eighths of industrial accidents traceable in some measure to the "human element," increasing stress is being put on safety education of workers. Half of our industrial accidents come from falls and from slipshod ways of handling boxes, tools, and other objects. To teach carefulness, employers use posters and motion pictures, conduct classes to train employees how to handle machines and other elements of their work correctly, and hold safety contests. Applicants for jobs are tested to find whether they are fit to work safely. In railroading and other transport industries, for example, engineers are tested for physical defects, such as color blindness. Tests are also applied to find whether applicants belong to the "accident-prone" group of people who are likely to have more accidents than others in the same work.

Common Accidents and How to Prevent Them

BUT SAFETY engineers and public agencies can do only a part of the work of cutting down the accident toll. Most of the responsibility must fall on the individual—on *you* and your fellow citizens. At home and at school, on the road, on the farm, and in all out-of-door activities, the problem of safety is chiefly a personal problem.

"Safety through skill"—that excellent slogan of the Boy Scouts—should be the motto of everyone. For skill usually means safety. Accidents rarely happen to experts. They know the right way to do things and the way to avoid unnecessary dangers.

1. HOME SAFETY

Home should be the safest place of all, but carelessness makes it one of the most dangerous. Because we keep on using tables and chairs as ladders, misusing kitchen appliances, and leaving things on the stairs for someone to trip over, more persons are killed in home accidents than in all the factory, mine, railroad, and farm accidents put together.

How to Guard against Falls

Falls are the largest single cause of home accidents. Stout window screens and gates at the top of stairs will protect small children against falls from windows and down stairs. Every staircase should have a strong handrail and should be well lighted. Loose treads and bulging pieces of stair carpet should be fastened down. Mops and brooms should be put in closets, not left to clutter cellar stairs. A night light or an extension cord reaching to the bed will save many a bump and fall in the bedroom. Small rugs on polished floors should be kept from sliding by a rubber backing or by fastening them down, especially when they are at the top or the bottom of stairs. A rubber mat and a hand grip will prevent slipping in the bathtub. Many kitchen falls can be prevented by smoothing warped linoleum, and wiping up spilled water and grease. Avoid using a table or a chair as a makeshift "ladder." A stepladder must be true to the floor and folding legs should be fully extended.

Safeguards against Burns and Fires

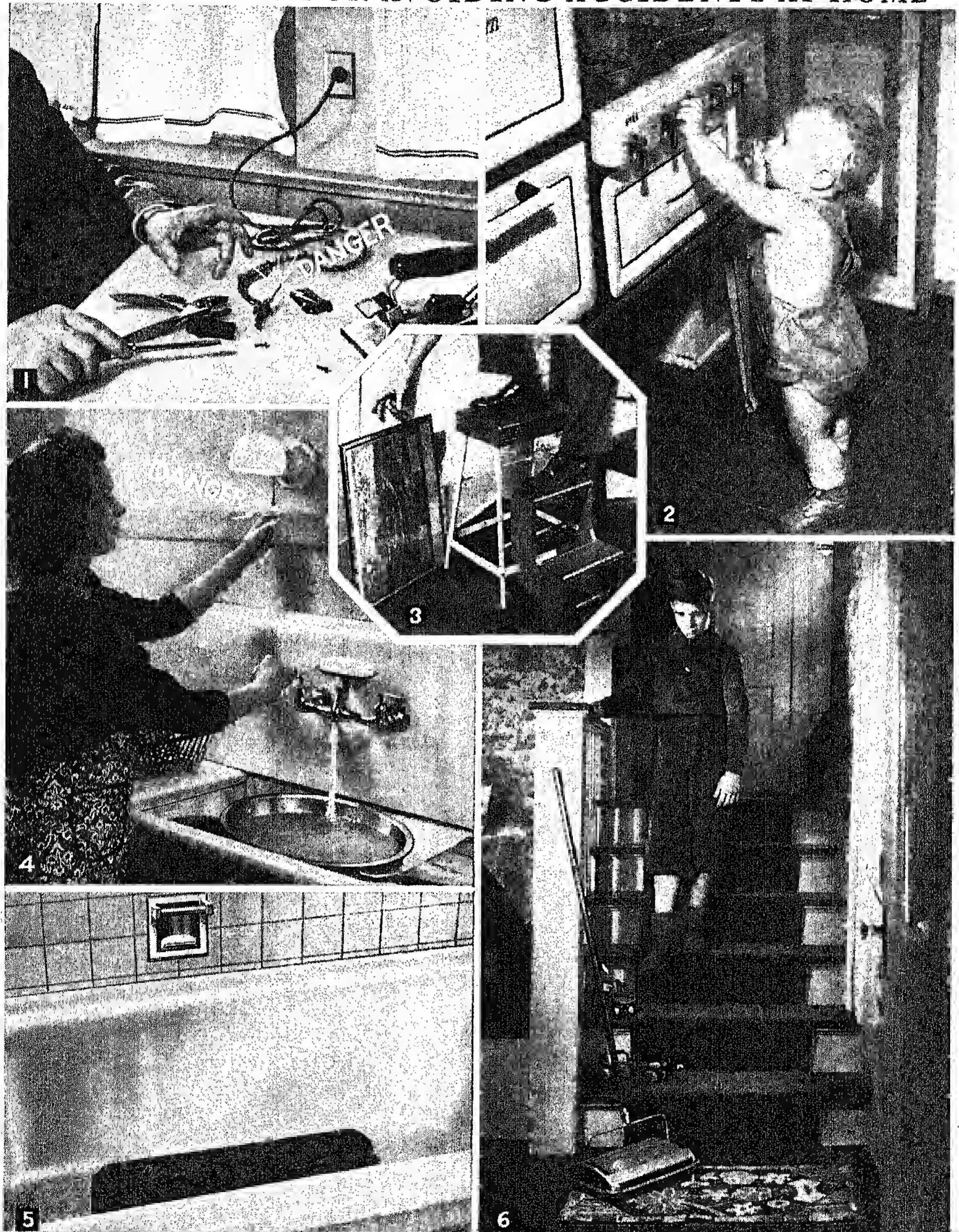
Two-thirds of all fatal burns occur in the home, and a large number of them are caused by carelessness in the kitchen. Handles of pans should be turned inward from the edges of the stove. This is especially necessary to protect small children, for burns and scalds are among the commonest injuries to them. When cooking with deep fat, one should stand back to avoid grease spurts. To avoid steam scalds, lift the *far* edge of a utensil cover. (For other safeguards, *see* the section "How We Can Aid in Fire Prevention" in the article Fire Department.)

Guarding against Electrical Accidents

Nearly every electrical accident can be prevented when you know and remember two things: (1) the human body can conduct electric current; (2) any object becomes a conductor when it is wet. Severe electric shock paralyzes the muscles. If heart or lung muscles are paralyzed, death usually results unless artificial respiration is applied at once.

Before repairing any electrical appliance, disconnect it by pulling the plug from the socket. Merely

SUGGESTIONS FOR AVOIDING ACCIDENTS AT HOME



1. Disconnect electrical appliances before starting to repair them. Keep cords in repair, as frayed insulation and exposed copper wires may cause short circuits and shock. 2. Never leave a small child alone in the kitchen; he may turn on the gas jets, touch the hot burners, or upset cooking utensils. Turn the handles of pots and pans so that he cannot reach them. 3. Use a stepladder—not a chair, stool, or box—to hang pictures and curtains or to reach a high shelf. 4. Never touch electrical appliances with one hand and a water faucet with the other; and especially never use them while in the bathtub. Water is a conductor of electricity, and if the appliances are faulty the current will travel to the water through your body. 5. A rubber mat in the bathtub and a hand-grip in the wall will prevent falls. 6. Keep stairs clear of toys and other articles. Keep your hand on the bannister. Stairs should be well lighted, and small rugs at top and bottom should be held down by mats or by suction devices to keep them from slipping.

turning off the switch is not enough, for the switch or the wiring may be faulty, permitting the current in the house circuit to give you a shock. Before repairing wall sockets, lighting fixtures, or other equipment that cannot be detached from the home circuit, shut off the current at the fuse box by removing the appropriate fuse or opening the main line switch. For all electrical work, use tools with insulated handles, and avoid touching two wires or appliances at the same instant. Take care not to touch any plumbing fixture at the same time that you are touching a wire or appliance. Do not use both hands to connect or disconnect an appliance. Modern home wiring has become so complicated that repair work and permanent installations should be entrusted only to an electrician.

When hands or feet are damp, even with perspiration, avoid touching any appliance; and do not switch an appliance on or off or touch a wire when you stand on a damp floor. It is best to have wall switches for all bathroom fixtures; if a chain-pull is used, it should be fitted with a porcelain or fiber "interrupter." Do not touch a switch and any metal, such as a faucet, at the same instant. No electric appliance that requires handling, such as a curling iron or a heater, should be used in the bathroom. Every basement fixture should be controlled by a push-button switch. When using electric washers or other laundry appliances in the basement, wear rubbers or stand on a piece of dry wood.

"Live" Wires and Short Circuits

Never touch a dangling or broken outside wire. Any wire, even a radio antenna or telephone line, may be "live," for it may have sagged or fallen against a high voltage line. If an outside power line breaks, keep people away and notify the electric company or the police station. If a person or animal has been shocked, do not touch him, but push the wire away with a dry piece of wood or a heavy cloth. If possible, stand on wood while doing this. Then apply artificial respiration (*see* First Aid).

All wires in the home should be insulated with stout covering, since cheap insulation wears rapidly. Cheaply-made appliances often have thin insulation or rough edges that fray the insulation, and if the exposed wires touch each other, they short the circuit and may start a fire. Avoid laying radio and other wires beneath carpets or over nails or where rubbing will wear them. Appliances should never be disconnected by pulling on the cord, since a pull may damage the plug or the wire. They should not be cleaned with a damp cloth while attached, since they may have unnoticed shorts.

When a fuse blows because of a short, a penny or piece of metal should never be used in place of a new fuse. The substitute will allow the short to continue, thus building up a dangerously heavy load of current. The same danger arises from installing a larger fuse. Most household branch circuits should use fuses of not more than 15 amperes. Before replacing a fuse, switch off the current. Use only one hand to screw the fuse, and keep the other off the fuse box or any metal part.

Protection Against Gases and Poisons

Gases from oil, coal, and gas stoves and from automobile exhausts are dangerous hazards. Some of these gases can be detected by their odor, but one of the deadliest, carbon monoxide, is odorless (*see* Carbon Monoxide and Dioxide). Hence even the smallest leaks are dangerous. See that gas cocks are completely closed, and if you smell escaping gas extinguish all flame, including the pilot light on the gas range, and open the windows before looking for the leak. And of course, when hunting in the dark for a gas leak, use a flashlight—not a match. Gas stoves should have vent pipes leading to a chimney or outdoors. Furnace fires should be carefully banked at night. Hot-air furnaces should be frequently inspected for leaks which may admit gas to the register pipes. Garage doors should be opened before an automobile engine is started.

The best safeguard against poisons is to "watch what you are doing." Before using medicine, read the label. All poisonous materials—such as certain medicines, ammonia, caustic soda, and lye—should be locked in a box and put out of reach of young children. (For antidotes, *see* First Aid; Poisons.)

Importance of Clean Yard and Walks

In icy weather walks should be spread with ashes, sand, dirt, or salt. Put rakes and other tools where they will not trip people. Remove "collision" hazards —take down the clothes line before dark, and prune bushes back from walks and doors. Nails, broken glass, and other trash should be put in a basket.

2. SCHOOL SAFETY

Many schools have Junior Safety Councils or other student organizations which act as steering committees for safety work through the school. Safety patrols from the upper grades prevent traffic accidents by directing pupils to cross the streets near the schools at the right times and places. (A handbook telling how to organize Councils and patrols may be obtained for a small sum from the National Safety Council, 1 Park Ave., New York City.)

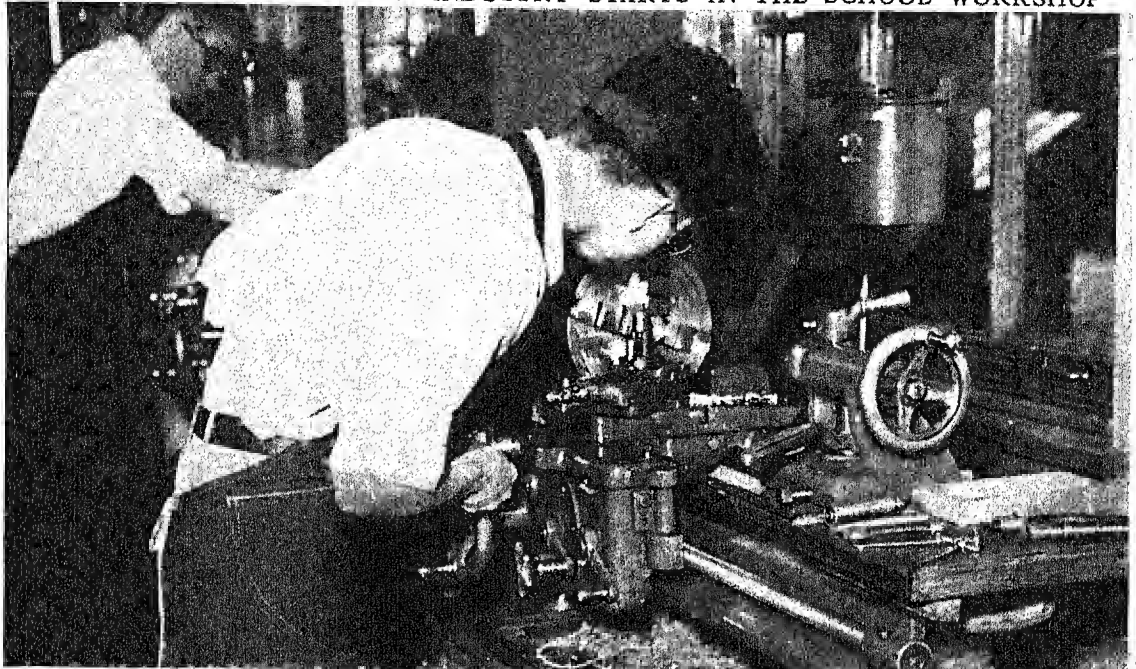
But safety at school, as elsewhere, depends most of all on the individual. Every child must coöperate by forming the right habits, learning the proper skills, and "thinking of the other fellow."

Falls can be reduced by keeping schoolroom furniture in orderly arrangement, desk drawers shut, and feet beneath the desks. Pencils, pens, scissors, and other sharp articles should be kept with ends pointing into the desk. As some 20 per cent of accidents in the school building occur in halls and on stairs, reduce the hazards of falls by walking, not running.

Gymnasium, Vocational Shops, and Playground

Obeying orders is one of the chief ways to prevent accidents in the gymnasium, where more than one-third of accidents in the school building occur. Avoid trouble by remembering it is childish to "show off."

TRAINING FOR SAFETY IN INDUSTRY STARTS IN THE SCHOOL WORKSHOP



These boys have learned the importance of exercising care in working with machinery. They have removed their neckties and rolled up their sleeves to keep them from getting caught in moving parts. They wear close-fitting goggles to protect their eyes from flying sparks or splinters. The machines are equipped with protective devices to make them as nearly "fool-proof" as possible.

Do not try new "stunts" till the instructor trains you. Wear well-tied shoes with ridged-rubber soles to prevent slipping. Keys, penknives, pencils, and other hard objects should not be carried in gymnasium clothes. Do not leave soap on the shower-room floor. In the swimming pool, be alert. Before diving, see that you will not hit a swimmer. Walk on the rubber mat instead of the wet tiles, and do not run.

Swings and other playground equipment should be tested each time before being used, and defects reported. Students should ask the instructor for a demonstration before trying new kinds of equipment. When using rings and swings, look to see that no one will be struck when the equipment is released. Baseball, "catch," tag, and other running games should not be played near young children.

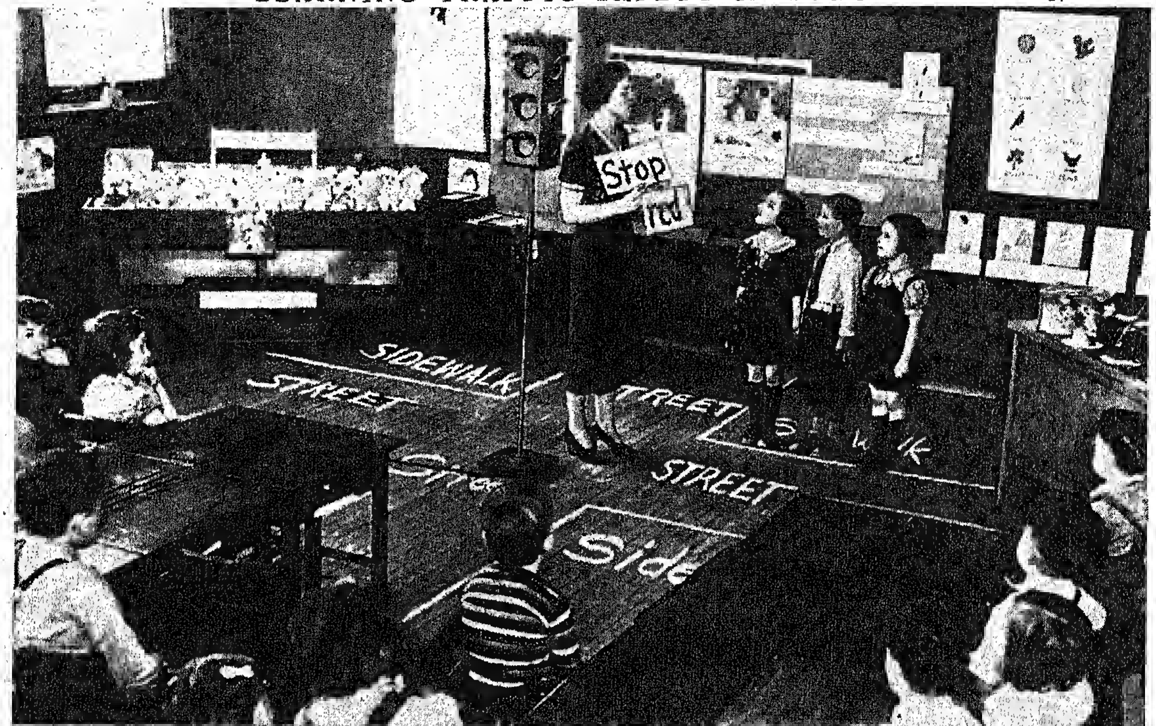
Kitefliers must be aware of the danger of getting a bad electrical shock if a damp kite string comes in contact with a live wire. For the same reason, wire should never be used in place of a cord or in connection with it. If a kite gets tangled around a wire, leave it alone. Many fatal accidents are caused by trying to get kites down from wires.

In school laboratories and shops, as in industry, most accidents can be prevented by handling equipment and machinery correctly. That is why instructors teach certain ways to perform laboratory experiments, to use tools, and to operate machines. Short-cut methods are not "just as good." In chemical laboratories the chief hazards to guard against are poisonous fumes, explosions, and burns caused by carelessly getting too near the almost invisible flame of the Bunsen burner. To avoid entangling clothes in shop machinery, sleeves should be rolled above the elbows, tie removed, and work apron fastened securely. Machines should be stopped before stock is removed. Goggles should be worn for grinding, chipping, welding, and lighting a furnace. A solder furnace should be opened before lighting to avoid possible explosion from gas leakage. When working with a plane or other sharp-edged tool, *push* the tool so that the sharp edge moves from you—do not pull it toward you. Hold a chisel well up on the handle. When using a screw driver, place it true in the screw head and turn it slowly; with jerky turns, it may slip and cut your fingers. Before sawing, fasten the stock in a vise. Hammer heads and handles should be tight. Tools should not project over the work bench or lie on the floor, and spilled oil should be immediately wiped up.

3. STREET SAFETY

It takes two to prevent motor-vehicle accidents to pedestrians—the driver and the person on foot. Sometimes even the best driver cannot avoid an accident when a pedestrian acts foolishly or stupidly. Of every three pedestrians killed on streets and roads, two were violating traffic laws or acting in an obviously unsafe manner. In this motor age, pedestrians must form safe walking habits and they must exercise good judgment. Above all, they must have a coöperative attitude with drivers. Stubborn, reckless, and selfish walkers who act "as if they owned the streets" are inviting trouble.

LEARNING TRAFFIC SAFETY IN SCHOOL



Children in the first grade make a game of learning to cross streets safely. A miniature traffic signal is set up in the schoolroom and the floor is chalked off into "street" and "sidewalk." The children walk down the sidewalk to the street, and as the electric lights flash red, green, or yellow, the teacher holds up cards labeled "stop," "go," or "get ready."

Among the commonest causes of street accidents are walking against traffic signals, crossing streets without looking to see if a car is coming, darting out from behind parked cars, and entering or leaving cars on the left side.

Correct Way to Cross a Street

Cross busy streets only at intersections. Observe traffic lights; it is at least twice as dangerous to cross against the signal as with it. Before crossing at unprotected corners, look in all four directions, not just two, and wait if an automobile is coming. Even if the driver sees a pedestrian at once, it may take him as much as three-quarters of a second to apply his brakes. Tests show that a driver going 20 miles an hour travels about 52 feet before he stops his car; 30 miles an hour, 100 feet; 40 miles an hour, 164 feet; 50 miles an hour, 243 feet. And when streets are wet or icy, the driver may not be able to stop in less than half a block even at low speed. Darkness more than doubles the risk of the pedestrian. It is harder for the driver to see him, and harder for him to judge the speed of an approaching car. It is best to wear or carry something white that will show up in the beam of the headlight.

Bicycle Riders and Skaters

Good bicycle riders must be able to ride without wabbling and to make quick stops and turns. A bicycle should be equipped with bell or horn, headlight, and tail-light or red reflector. White stockings and a white handkerchief tied on the upper arm will help drivers at night to see a rider at a distance. Cyclists should obey traffic rules, ride along the right curb, travel in single file, and signal before turning. Before crossing through streets and before riding from alleys, they should stop. Special care should be taken at intersections, for half or more of rider injuries occur at crossings. Good riders do not carry passengers on handlebars or try trick riding in traffic. Only foolish riders hitch on other vehicles.

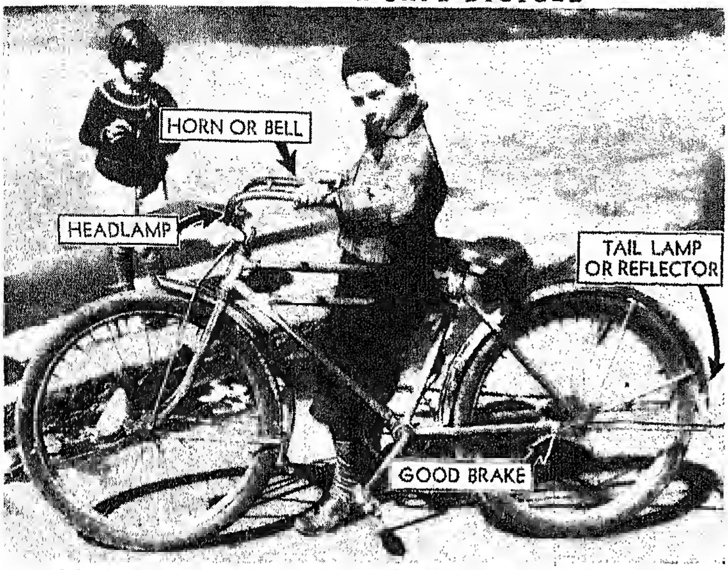
Roller skaters should practise quick stops and turns. They should take off their skates and walk across busy intersections. Skaters should give pedestrians right of way, and go in single file when passing.

4. DRIVING SAFETY

Young motorists have special responsibility to improve their driving skills, for they have a larger proportion of accidents than do older persons. Drivers under 20 years of age have a fatal accident rate about a third higher than those between 30 and 39 years, and nearly twice as high as those between 40 and 49.

The good driver always obeys traffic laws and the rules of the road (*see* Automobile). Moderate speed is best. At speeds under 20 miles an hour, only one accident in 70 is fatal; at speeds of more than 50 miles an hour, one in 13 is fatal. Granting the "right of way" to another driver will save many collisions. On long trips, eat lightly; and every two hours, get out and move about a few minutes. In coun-

THIS BOY HAS A SAFE BICYCLE



A good brake kept in good working condition is the first requirement of a safe bicycle. Other necessary equipment, which is required by law in many places, includes a horn or bell, a head lamp, and a tail lamp or reflector.

try driving, watch for automobiles coming from side-roads or farmhouses. One should make a complete stop for live stock, and then pass slowly.

Braking with Engine and Handling Skidding

Using the engine as a brake is helpful in stopping on wet or icy pavements. This is done by pressing on the foot brake *without* disengaging the clutch. To stop on slippery pavements apply the brakes gently and repeatedly, instead of in one continuous action. Do not coast down hills but keep the clutch engaged. Shift into second speed or low for steep hills. Do not apply the brake while going around a curve; it may bring on a skid or an upset. Slow down before reaching the curve; then, after your car starts the turn, give it more gas. Thus the driving force of the rear wheels will offset the tendency to tip and sway.

If skidding starts, braking will only make it worse. Instead, accelerate slightly and turn the front wheels in the *same* direction as the skid. If a blowout occurs, do not brake but take your foot off the accelerator and let the car come to a gradual stop.

Make it a habit, even on empty roads, to keep over on the right-hand side. Never turn out into the left-hand lane to pass a car unless you can plainly see that your path is free from oncoming machines. Never try, under any circumstances whatsoever, to turn out around a car near the top of a hill or on a blind curve, for you will not be able to see oncoming cars until it is too late to avoid a head-on collision, which is usually fatal.

Courtesy to Other Drivers

Many accidents are caused indirectly by drivers who are careful of their own safety but inconsiderate of others. If an autoist persistently straddles two lanes of a highway, he forces those who want to pass into a dangerous situation. And the man who backs up traffic behind him by driving at 20 miles an hour on a road where the legal limit is 35 or 40 miles may consider himself responsible for the accident that may result when some exasperated driver in his rear takes a risk to get past. The autoist who chooses to drive more slowly than the average should keep off the main highways, or he should watch the road behind in his rear-view mirror and when he sees he is holding up other cars he should turn off the road to let them pass.

5. SAFETY IN OUT-OF-DOOR SPORTS

Water safety includes knowing how to handle boats, to swim, to aid swimmers in distress, and to remove your clothing and shoes in the water. Everyone should learn how to swim (*see* Swimming). To avoid the risk of stomach cramps, one should not enter the water un-

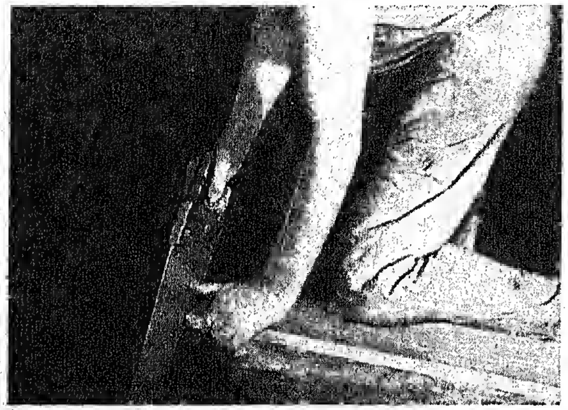
A SCHOOL SAFETY PATROL "ARRESTS" A FELLOW STUDENT

The offense of running between parked automobiles into the street will bring the boy on the left before the school traffic court. He may be penalized by extra duties or loss of privileges. Many schools have found such courts useful in the safety program.

til an hour and a half after a meal. Before diving into strange water, swimmers should test it for depth, rocks, and weeds. Stay near shore unless you are an expert. A chilly or tired feeling means that you should leave the water. Foot or leg cramps can usually be cured by rubbing briskly while treading water or floating.

Never "buck" a current or undertow. Swim diagonally *with* a current toward shore; turn and go *with* an undertow, then slant upward, and swim to the surface. If thrown into water while dressed, do not try to swim weighed down by clothes. Take time to breathe deeply, duck under water with your eyes open, and double up so that you can reach to untie your shoes. Then remove trousers or skirt. Do not try to swim ashore from an overturned boat. Hold on to the boat and wait for help. (For correct way to handle boats, *see* Boats and Boating; Canoes and Canoeing.)

RIGHT WAY TO USE A SAW

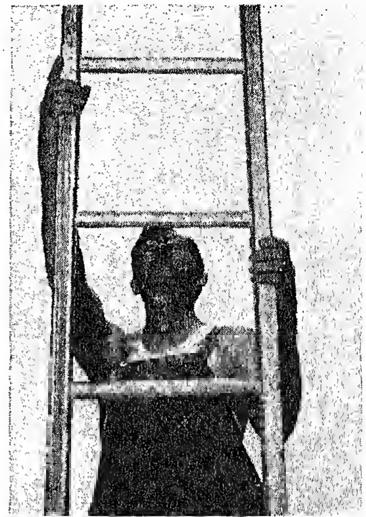


To prevent a saw from jumping, guide it with the thumb of the left hand held along the side of the blade.

There would be fewer accidents with firearms if everyone acted on the assumption that "a gun is always loaded." The muzzle should be pointed in a safe direction — away from people and buildings. It should not be pointed at the ground, for a bullet may ricochet. Even with the safety-lock on, a gun should not be pulled muzzle first from a boat or through a fence. The gun should be put through the fence before the hunter climbs through. When a gun is passed to someone, the action should be open to make sure it is empty. Loaded guns should never be taken into a camp or a house. (For other safety rules in hiking and camping, *see* Camping.)

6. SAFETY ON THE FARM

HOW TO CLIMB A LADDER



When holding the sides, there is no danger of a rung breaking under your grip and letting you fall over backward.

Since the farmer has few safeguards in his varied work, safety habits are even more important to him than to industrial workers. Carelessness is the chief reason why the accident death rate in agriculture is much higher than in manufacturing. Machinery accidents, the commonest farm mishaps, can be prevented by the precautions described for vocational shops. Farm workers should not get on or off moving tractors or machines.

Animals are the second largest cause of farm accidents. Even the gentlest stock should be handled with care. Sharp tones or jerky movements should be avoided. The farmstead should be kept clear of hazards from trash and sharp instruments. Pitchforks, scythes, and all pointed tools should be put away with points downward—not hung from a rafter or tree branch.

Lightning hazards can be reduced by equipping all farm buildings with well-grounded lightning rods. Lone trees, fences, and isolated sheds should be avoided in storms, for lightning singles out isolated objects as the most direct route to the ground. It is safer to stand in the open, or in thick timber.

HOW TO LEAD A BULL TO PREVENT SUDDEN ATTACK

To guard against sudden attacks by bulls, a common cause of farm injuries, the farmer should face the animal and lead it by the nose with a long pole or stick.

When walking on country roads one should be especially careful, for the hazard to pedestrians has increased far more rapidly in the country than in the city. The most important habits to acquire are: (1) walk on the left side facing oncoming cars; (2) step off the road when cars are about to pass close to you; (3) at night wear something white or carry a light.

—REFERENCE-OUTLINE *for Organized Study of* SAFETY EDUCATION—

NO MODERN problem, perhaps, is more widely studied in the United States than safety, especially insofar as it relates to the causes and prevention of accidents. Schools, industries, civic groups, and the national, state, and municipal governments are constantly increasing their efforts to reduce accidents. The following outline covers material on this movement and supplies references to the many aspects of safety treated in other articles in this Encyclopedia.

I. THE SAFETY PROBLEM:
A. Need of Conserving Nation's Human Resources: C-343–4.
B. Economic Loss through Accidents: S-2.
C. Reasons for High Accident Rate in United States: S-2.
II. GROWTH OF THE SAFETY MOVEMENT: S-2*a*.
A. Beginnings in Industry: S-2*a*, I-74*g–h*, L-44. Early Laws F-2, L-43, C-205, E-263.
B. Chief Measures and Agencies of the Federal Government: S-2*b–c*, U-223, U-227–8, U-230, H-254.
C. State and Municipal Measures and Agencies: S-2*b*, S-2*c–d*, M-302. Fire and Police Departments F-53, P-287; Health Service H-254, H-256, H-370.
D. Safety Education in the Schools: S-2*a*, S-2*c*, S-2*f*.
E. Private Organizations: National Safety Council S-2*a*; Red Cross R-60; Boy Scouts B-211–12.
F. Safety Engineering Profession: S-2*d*.
G. Insurance: I-94.
III. SAFETY IN INDUSTRY:
A. Legislation and Its Enforcement: S-2*a*, S-2*b–c*. Factory and Labor Laws F-2, L-43, C-205; Employers' Liability E-263; Factory Inspection H-256; Federal Bureaus S-2*b–c*.
B. Efforts of Industry: S-2*a*, S-2*d*.
C. Safety Devices: S-2*d*. Automatic Devices A-385; Fireproofing F-59; Electric Fuses A-132; Brakes B-225; in Mining C-286, P-113 picture, D-20.
IV. SAFETY ON THE FARM: S-2*j*.
V. SAFETY IN TRANSPORTATION AND TRAFFIC:
A. Crusade to Cut Down Automobile and Traffic Accidents:
  a. Making Streets and Highways Safe: S-2*a–b*, A-392.
  b. Driving Laws: A-392, S-2*b*.
  c. Educating and Testing Drivers: S-2*b*, A-407.
  d. Rules for Safe Driving: S-2*h*, H-374, C-82.
  e. Rules for Pedestrians, Bicycle Riders, Roller Skaters: S-2*g–h*.
B. Railroads: Safety Devices R-40, R-43, B-224–5, A-385; Operating Control System R-42-4; Intersections S-2*b*; Government Inspection S-2*b*.
C. Safety at Sea: Lighthouses and Lightships L-131–4; Life-Saving Service L-123–4, U-227; Coast Guard C-289–90, I-4; Weather Forecasts W-59, W-61–2; Ship Construction S-127; Navigation N-46–9; Gyroscope G-192.
D. Safety in the Air: S-2*b*. Airways A-80–1; Weather Forecasts W-61-2; Safety Devices A-90, A-92.
VI. SAFETY IN THE HOME:
A. Home Accident Toll: S-2*d*.
B. Ways to Make the Home Safe: S-2*d*.
  a. Avoiding Falls: S-2*d*.
  b. Food Protection, Air and Ventilation, Lighting, Plumbing: H-373–6, P-260.
  c. Protection against Burns, Fires, Explosions, Gases: S-2*d*, S-2*f*, F-56–8, B-265–6, C-82.
  d. Avoiding Electrical Accidents: S-2*d*, E-227.
  e. Protection against Poisons: S-2*f*, F-64, P-274.
  f. Keeping Yards and Walks Clean: S-2*f*.
C. First Aid: F-62.
VII. SAFETY IN THE SCHOOL:
A. Accident Prevention in Classroom, Gymnasium, Vocational Shop, and Playground: S-2*f*.
B. Safety Education: S-2*a*, S-2*c*, S-2*f*.
VIII. SAFETY HABITS FOR OUT-OF-DOOR SPORTS:
A. Water Safety: S-2*i–j*, C-75–6, C-47*b*, S-345.
B. Camping: C-45–6, C-47*b*.
C. Firearms: S-2*j*.
IX. SAFEGUARDING PUBLIC HEALTH:
A. Public Health Service: H-254, M-98, D-4–5.
B. Pure Food Laws: P-368*d*–69.
C. Sewerage, Waterworks: S-87, W-54–6.
X. SAFEGUARDS AGAINST FIRE AND FLOODS:
A. Fire Prevention Rules: F-56–8. Forest Fires F-159.
B. Flood Control: F-106*b–c*, M-204, M-211, T-49.
XI. SAFETY IN NATURE:
A. How Plants Protect Themselves: P-241, P-272.
B. Protective Coloration in Animals: P-353–6.

Bibliography for Safety

—Books for Younger Readers:
Andress, J. M. and others. Safe and Healthy Living, 8v. (Ginn, 1939).
Beard, H. E. Safety First for School and Home (Macmillan, 1924).
Boy Scouts of America. Safety (Merit Badge Series, No. 3347)
Brownell, C. L. and others. Adventures in Safety (Rand, 1939).
Bryce, C. T. The Safe-Way Club (Nelson, 1938).
Buckley, H. M. and others. The Road to Safety, 8v (Amer Bk. Co, 1938).
Cannon, F. V. Rehearsal for Safety (Dutton, 1939)
Crump, Irving. Our Firemen (Dodd, 1938).
Evans, W. A. and Fry, M. B. Safety, Your Problem and Mine (Lyons, 1938).
Floherty, J. J. Fire Fighters! How They Work (Doubleday, 1933).
Gentles, H. W. and Betts, G. H. Habits for Safety (Bobbs, 1937).
Hyde, F. S. and Slown, R. C. Safety Programs and Activities for Elementary and Junior High Schools (Beckley-Cardy, 1935).
Leaf, Munro. Safety Can Be Fun (Stokes, 1938).
Nelson, Florence and Cottrell, H. L. Safety Through the Year (McGraw, 1937)
Norris, Margaret. Heroes and Hazards (Macmillan, 1932).
Stack, H. J. and Schwartz, E. Z. Safety Every Day (Noble, 1939).
—Books for Advanced Students and Teachers:
Allen, T. H. J. Safe and Sane Use of Highways (Halo, 1935).
American Association of School Administrators, Commission on Safety Education. Safety Education (18th Yearbook, 1940).
American Automobile Association. Sportsmanlike Driving Series.
Baarslag, Karl. Coast Guard to the Rescue (Farrar, 1937).
Bryant, C. L., ed. Life Saving and Water Safety (Blakiston, 1937).
Cobb, W. F. Everyday First Aid (Appleton-Century, 1937).
Dull, C. E. Safety First—and Last (Holt, 1938).
Floherty, J. J. Youth at the Wheel (Lippincott, 1937).
Fox, F. C. Safety Education (Lippincott, 1937).
Greenwood, Ernest. Who Pays? (Doubleday, 1934).
Hamilton, J. R. and Thurstone, L. L. Safe Driving (Doubleday, 1937).
Hoffman, P. G. Seven Roads to Safety (Harper, 1939).
Holbrook, S. H. Let Them Live (Macmillan, 1938).
Hughes, R. O. Building Citizenship (Allyn, 1933).
Kreml, F. M. and others. Public Safety (Bobbs, 1937).
National Bureau of Casualty and Surety Underwriters. Guide-Book for Safety Education.
Reigeluth, R. J. Safety and Economy in Heavy Construction (McGraw, 1933).
Stoekel, R. B. and others. Sense and Safety on the Road (Appleton-Century, 1936).
White House Conference on Child Health and Protection, 1930. Safety Education in Schools; Report (Appleton-Century, 1932).
Wood, Clement. Carelessness: Public Enemy No. 1 (Hillman-Curl, 1937).
Useful pamphlets may be obtained from:
National Board of Fire Underwriters, 222 West Adams Street, Chicago, Ill.
National Fire Protection Association, 60 Batterymarch Street, Boston, Mass.
National Safety Council, 1 Park Ave., New York, N. Y.
Among the periodicals which contain valuable safety material are *Hygeia*, *Public Safety*, *Safety Education Magazine*.

SAGEBRUSH. Over immense areas of the arid plains of western United States, clumps of gray-green sagebrush, dotted here and there over the sand, form the principal vegetation. Of the several varieties,

the best known and most abundant is the common or bitter sage. Usually it grows as a dwarfed shrub, although sometimes it attains almost treelike proportions, with the twisted and knotty trunk measuring nearly a foot through near the ground.

Some varieties, principally the salt sages, so called because they grow in waste land containing so much alkali that little other vegetation can exist, are important winter forage for sheep and are occasionally eaten by cattle when other food is very scarce. Black sage, which sometimes grows to a height of ten feet or more, is used as fuel by the settlers in some of the more isolated regions. Nevada has been nicknamed "The Sagebrush State" on account of the great amount of sagebrush growing there.

The common or bitter sage is *Artemisia tridentata*. Tarragon, a popular flavoring for vinegar, is a European variety of Artemisia, *Artemisia dracunculus*. (For the flavoring herb called sage, *see* Mint.)

SAGO. The sago of our puddings has traveled far to take its place as the basis of a nutritious dessert. It is obtained from the starchy soft inner portion of the sago palm. The world's supply comes from the Straits Settlements and the Dutch East Indies.

The sago palms grow to a height of 30 feet or more in low marshy soils. Their strong trunks have a hard outer layer, nearly two inches thick, and inside this is the spongy portion which contains the starch product. The trees flower only once, when they are about 15 years old, and die after maturing their seed. To make sago they are cut down just before they are ready to flower, for the production of the fruit exhausts the starch center. The pith is chopped and grated to a powder and mixed with water to extract the starch particles. This is kneaded in water in a sieve or cloth, the water carrying off the starch and leaving the woody fiber behind. The starch is then allowed to settle and is dried. When pressed through a sieve it forms fine pearly grains which are the "pearl sago" of commerce. It is eaten in the form of cakes or soup by the natives, to whom it is an important article of everyday diet. Sago is rich in carbohydrates (starch and sugar) and is easily digested. A single tree often yields 700 pounds of pith.

The spineless sago palm *Metroxylon laeve* and the prickly sago palm *Metroxylon rumphii* furnish the bulk of the sago exported to Europe and America. South America has two sago-yielding palms.

KING SAHARA *and His* DAUGHTER DESERTS

The Burning Wastes of the Great African Desert and Its Continuations across Central Asia—Why Rain is Lacking and How the Vast Sand Dunes Have Been Made—Oases and Caravans

SAHA'RA. If you will look at the map of the world and sweep your finger from the westernmost coast of Africa in a diagonal line to far-away Manchuria in eastern Asia, you will have traced roughly the backbone of the great desert belt of the Old World. For a stretch of 10,000 miles, interrupted only by a few great streams, one desolate region succeeds another. First comes the Great Sahara Desert, which, beyond the narrow valley of the Nile to the east, becomes the Nubian desert. Then the arid waste leaps the Red Sea and merges into the Arabian and Syrian deserts. Waste lands then continue in patches through Persia, branching southward to the great desert of Sind in India, and northward over the barren highlands of central Asia to the immense sandy stretches of the Gobi desert in Mongolia. Altogether it is a vast desert chain, stretching almost halfway around the world, with little or no rainfall, so that plant life barely subsists.

Of all these deserts, and of all other deserts in the world, the Great Sahara is king. With a length of 3,200 miles and an extreme breadth of 1,400, making an area of about 3,500,000 square miles, the Sahara is nearly equal in size to all of Europe. From the Atlas Mountains on the north to the Sudan on the south and from the Igidi region of Morocco to the Nile valley, there is not a single river. Occasionally the "wadies," or dried beds of ancient streams, will carry torrents of water after one of the rare cloudbursts, but this is quickly swallowed up in the thirsty earth, or goes to feed the infrequent springs and wells which form the center of scattered oases.

Far from being merely a great rolling waste of sand, as is often believed, the Sahara contains many lofty and rocky ranges and plateaus in the interior, some with peaks from 8,000 to 9,000 feet in height, crowned with snow in the winter. The lack of rain in the Sahara is due to the great land mass of Africa, which causes an outflow of air during the winter, thus driving away ocean moisture. In the summer, when there is an inflow of winds, the ground is so intensely heated that the winds are dried up before they have reached far inland. In the eastern part are several spots below sea level, usually containing oases, which show the natural fertility of most of this desert soil wherever moisture is sufficient. The chief habitable areas are Tuat, south of Algeria, and Ghat and Kufara, to the south of Tripoli. Greatest of the oases is El Erg, just south of the Atlas Mountains, where enough water is found to irrigate between eight and ten million date palms.

The great shifting sand dunes of the Sahara are believed to have been created by the violent and sudden changes of temperature. Under the boiling noonday sun the ground sometimes gets as hot as 200° F., yet at night the temperature may fall below

THE VAST WAVES IN THE SEA OF SAND

Only the tracks of small wild creatures break the rippling surface of the wind-sculptured sand waves stretching away to the far horizon. Here is the home of the wandering Arab and Tuareg with his camels.

freezing. This causes the natural desert rock to crumble, forming sand which is then swept up by the wind and whipped against other rocks, eating them away in turn. Portions of the Sahara undoubtedly formed the ocean bed at one time, for fossil remains of salt-water creatures have been found.

The wild animals found in the desert today are jackals, foxes, hares, a few gazelles and antelopes, and a few species of birds, including the ostrich, the vulture, and the raven. The central desert is inhabited by the wild robber tribes of Tuaregs; the east by Bedouins and Tibbu, the latter of mixed negro stock; and the west by Berbers.

Outside of a Spanish colony (Rio de Oro) on the west coast, and the Fezzan, which is attached to the Italian colony of Tripoli (Libya), the greater part of the Sahara west of the Nile valley is French.

The principal cities in the Sahara, or so close to its fringes that they serve as caravan centers, are Ghadames, Murzuk, Kufara, Ghat, and In Salah, in the north; and Kukawa on Lake Chad; and the famous Timbuktu on the Niger River in the south.

The French are pushing railway lines into the desert from the north and are constantly boring new artesian wells to bring prosperity to the scattered tribes they have now in most part subdued. Airplanes carry mail to distant military posts. Automobiles have traversed its length and breadth, and regular passenger service has been established between many cities. France has under consideration various engineering projects by which it is hoped some day to reclaim vast tracts.

Over the Burning Sands with a Caravan

IT is three o'clock in the morning on the edge of the great Sahara desert. The stars are still shining through the date palms that sway in the light breezes from the south. Scattered over the ground are black humped shadows of sleeping camels. Smaller dark blots are grazing donkeys and goats, and here and there are the white, outstretched figures of Arabs. One of the figures stirs and rises, gazes a moment at the sky, and sends out a long weird call.

The effect is like magic. On all sides noisy life springs up from silent sands. Camels lift their long necks with complaining groans, donkeys bray, goats bleat, dogs bark, men shout to one another as they bustle about in the growing dawn. Small fires blaze up. The Arabs are at their prayers or rolling up their mats, while black servants prepare the simple breakfast and load the complaining pack animals.

It is the hour for the big caravan to start on its thousand-mile journey southward across the desert. By the time the orange-gold of the morning sunlight touches the tip of the highest date palm, the long line of men and beasts is on its way. Slowly it crawls like a huge loose-jointed snake over the endless wilderness of black rock and yellow sand.

At the head of the column rides the caravan chief on a prancing horse. A long rifle is slung over his back and his face and entire figure are muffled in flowing white. His word is caravan law. Behind him in narrow file pace hundreds of heavy-footed camels, balancing on their backs bales and boxes containing cotton cloth, silk, sugar, drugs, tea, small articles of metal, together with beads and scores of other trade articles. By their side walk the owners or drivers, leading donkeys who carry food and water for the long march. The goats, which furnish milk or are to be killed for meat, straggle along at the rear, keeping barely ahead of the snapping dogs that aid in herding them.

The Silent March under the Burning Sun

It has taken perhaps a year to gather the men and beasts and merchandise for this great caravan. Arab and Jewish merchants in the coast towns of North Africa—Tripoli, Tunis, Algiers—have invested their fortunes in those swaying camel packs. They will wait anxiously another year, perhaps, before these "desert ships," having cruised to the southern shores of the great ocean of sand, return with precious loads of ivory and gold, skins, and ostrich feathers, gathered by barter with the natives in the heart of Africa.

Meanwhile the caravan moves on, perhaps two miles an hour, treading the old trail worn deep by the pads of camels and the naked feet of men in the course of centuries. The sun rises higher, and the heat strikes down and flares up again from the sand in shimmering waves. The cries of the animals are hushed. The only sound is the creaking of leather in the packs, and the endless *pad, pad, pad—swish, swish, swish*—of the hundreds of heavy feet dragging across the soft shifting sands. To break the silence that leads to desert madness, and to forget that fierce burning light that bites at men's eyes and makes them blind, a plodding Arab starts a weird caravan song, timed to the monotonous beat of the camel's stride. The chant spreads up and down the line, and the empty hills echo the brave deeds of ancient heroes in love and war.

From ten in the morning until three in the afternoon the caravan rests to let the worst heat of the day pass by. If they have reached an oasis—where there is water and palms and green grass—men and animals may stretch themselves in the shade. If the stop is in the open desert, they lie or crouch on the sand, the men throwing their cloaks over their heads.

But the heat, the constant fear of a dried-up well that may leave men and animals to die of thirst, the sudden sandstorms that sweep across their path—these are not the only dangers that beset the caravan. For in the heart of the great desert dwell a strange race of men, the masked Tuaregs, who prey upon the caravan trade and, like pirates of the sands, levy tribute upon all who pass their way.

A FLEET OF "DESERT SHIPS" UNDER WAY

A caravan may include as many as 1,000 camels. Without these strange beasts, so marvelously adapted to life in sandy regions, even the Bedouin or the Tuareg could scarcely have achieved the conquest of the Sahara.

Perhaps while the march is on, the caravan leader will see black specks on the horizon moving rapidly forward. A halt is called. Soon two or three Tuaregs sweep up on their racing camels. They bargain with the leader. For a certain sum in money or merchandise they will protect the caravan; otherwise—

Stubborn caravan leaders have sometimes refused to deal with the Tuaregs. Some of those caravans were never heard of again; or perhaps a few survivors, dying of thirst, have staggered into an oasis to tell of a sudden ambush, the swoop of hundreds of masked men, shots, knives flashing, camels stampeded over the desert with their loads, and everything lost.

SAINT AUGUSTINE, FLA. Strange and exotic indeed seems this ancient town. Narrow but well-paved brick and asphalt streets, where in times past wheeled vehicles were not allowed; massive fortifications and ruins dating back to the Spaniards' times; old white-walled houses in the Spanish style, built of the native coquina (a stone like pudding-stone, but containing shells instead of pebbles); magnificent hotels in the Spanish Renaissance and the Moorish styles of architecture, but with more than Spanish or Moorish splendor and luxury—these, in a setting of semitropical foliage, today distinguish the oldest permanent European settlement in the United States.

In 1565, Pedro Menendez de Aviles, hastening to snatch Florida from the grasp of French Huguenot settlers (*see* Coligny, Gaspard de) and secure it for his master, King Philip II of Spain, founded St. Augustine on the peninsula between the Matanzas and San Sebastian rivers, on the Florida east coast. This was 42 years before Capt. John Smith and his companions landed at Jamestown, the first permanent English settlement. Yet the tardy English were to be

the bane of this remote Spanish outpost. Sir Francis Drake burned it in 1586; Capt. John Davis sacked and again burned it in 1665; Georgia and South Carolina harried and harassed it, and were in turn harried and harassed. When Florida was re-ceded to Spain in 1783, after 20 years of English possession, nearly all the English inhabitants of the city emigrated to the West Indies or to the United States.

The most important historic relics in St. Augustine are the old Spanish fort San Marco (begun about 1638; finished 118 years later), now called Fort Marion; the old city gates and fragments of the city wall, built as defense against the Indians; and the Plaza de la Constitution, where during the Revolution loyalists burned the effigies of John Hancock and Samuel Adams. St. George Street, the main thoroughfare, is only 17 feet wide. Probably more people are drawn to Saint Augustine by its winter climate and its splendid hotels than by its historic monuments. About 75,000 visit the city annually. The permanent population in 1940 was 12,090. Thousands more live in the suburbs.

SAINT-GAU'DENS, AUGUSTUS (1848–1907). As a "reg'ler boy" in the Bowery district of New York City in the early days of the Civil War, this immigrant son of French and Irish parents played tricks on shopkeepers and dodged policemen with the rest of his "gang." But he did more than this, for when 13 years old he was apprenticed to a cameo cutter, and besides, he attended the art school of Cooper Union and classes at the Academy of Design. He loved to sketch and model in clay, and when he was 19 years old, with only $100 of "saved-up" money, Saint-Gaudens went to Europe to study sculpture with the great artists of Paris and Rome.

He had a hard struggle there, for $100 didn't go very far even then, but he was able to pay his way by working at his trade of cameo cutting. Finally, after six years of study and practice in the studios of Europe, his work attracted the attention of a wealthy American who was in Rome. He helped Saint-Gaudens to get orders for work so that he was able to return to the United States and open a studio of his own in New York City—the first American sculptor who had had the benefit of a complete training in the greatest centers of European art.

Although Saint-Gaudens was born in Dublin, the home of his Irish mother, the family had removed to New York when he was only six months old. He was a real American and his great bronze statues reflect the spirit of the nation. His 'Puritan' (Deacon Chapin) at Springfield, Mass., represents the stern strength with which the New England forefathers endured and conquered. His 'Lincoln' in one of the Chicago parks is usually considered to be the finest portrait statue in America. Saint-Gaudens' greatest masterpiece, however, is on Boston Common—the memorial to Robert Gould Shaw, commander of the first negro regiment which was raised by the North for service in the Civil War.

New York possesses Saint-Gaudens' 'Admiral Farragut', in every line of whose garments and firmly braced figure we feel the ocean's gales; and his 'General Sherman', a mounted warrior preceded by the figure of Victory. Also notable is his equestrian statue of General Logan in Grant Park, Chicago, which is the embodiment of martial energy. Of another sort than these war memorials but of an art in which he was America's leader, is Saint-Gaudens' low relief plaque of his friend Robert Louis Stevenson, commemorating in bronze the charm of personality and frail health of this universally beloved author.

SAINT JOHN, NEW BRUNSWICK. In winter when ice has closed all the other important seaports of Canada except those of the Maritime Provinces, the great harbor of Saint John is always open. It lies at the mouth of the St. John River on the Bay of Fundy, whose immense tides, about 25 feet high at this point, coöperating with the waters of the river, prevent the formation of ice. This advantage, together with the short rail haul from the interior, serves to strengthen the city's position as one of the chief winter ports of Canada. It is the Atlantic terminus of the Canadian Pacific Railway and is also one of the termini of the Canadian National Transcontinental Railways, which bring the grain and other products of upper and western Canada for winter shipment.

One of its attractions is the natural wonder of the reversing falls in the St. John River. When the tide is out the falls flow toward the sea; at half tide or slack water they are open to navigation both ways; at high water or full tide the current flows inward, hence its title of "Reversing Falls."

Grain elevators, a large sugar refinery, cotton mills, iron and brass foundries, flour and rolling mills, saw and wood-pulp mills, wood-working factories, and other industrial establishments make Saint John one of the chief manufacturing centers of the Maritime Provinces. It was the first city in Canada to adopt the commission form of government. The name of the city and river comes from the circumstance that the explorer Champlain landed here in 1604 on the feast day of St. John the Baptist. It has been an important city since 1783, when it received an immigration of 10,000 United Empire Loyalists from the American colonies. Population, 47,514.

SAINT LAWRENCE RIVER. In the volume of its commerce, the comparatively short St. Lawrence is one of the world's most important rivers. The Great Lakes find in it their natural outlet to the Atlantic Ocean. On its broad stream moves grain from the twin ports of Duluth-Superior and Port Arthur-Fort William at the western extremity of Lake Superior, 2,350 miles from the sea. Petroleum products from Indiana Harbor, at the south end of Lake Michigan, travel down the St. Lawrence on a 2,270-mile journey to the Atlantic. The river proper, from the foot of Lake Ontario to Cape Gaspé at the entrance to the Gulf of St. Lawrence, is only 740 miles long. The gulf, from Gaspé to the open ocean, is about 430 miles long.

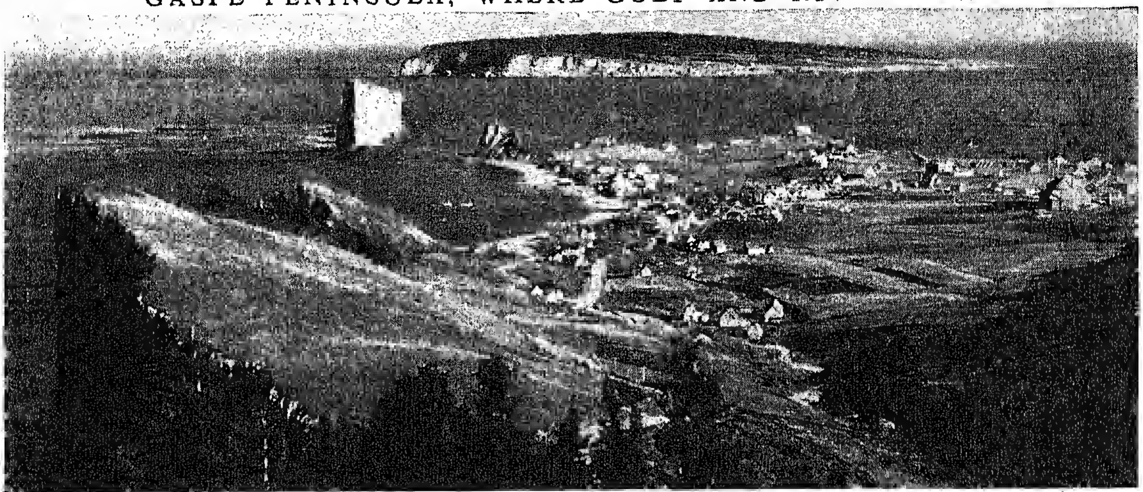
The St. Lawrence emerges from the foot of Lake Ontario and flows in a northeasterly direction until it discharges its waters into the Gulf of St. Lawrence—

> Then out to the sea with a stately sweep
> It mingles its tide with the mighty deep,
> As it has for a thousand years—

the outlet to the *Atlantic* being either south of Newfoundland past Cape Ray and Cape Breton, or north of Newfoundland through the Strait of Belle Isle. The latter course is the shortest route to England but not the one usually followed by vessels on account of the greater danger from fog and ice.

About 400 miles upstream from the island of Anticosti, which stands where the river's estuary widens into the gulf, is the quaint old French Canadian city of Quebec, built partly on a high bluff above the river. From Quebec to Montreal, 160 miles farther upstream, the channel has been improved to permit large vessels to reach the latter city. For a distance of 30 miles above Montreal there is a series of rapids which proved a formidable barrier to early exploration. The first of these, the Lachine ("China") Rapids, was so named by the French explorer Cartier because he believed the "great sea" beyond, as described to him by the Indians, was the Pacific Ocean (and not the Great Lakes), and that when once past the rapids he should find a new water route to China. Several canals with locks have been built around these rapids, so that vessels of 14-foot draft may now traverse the whole waterway. About 100 miles above the rapids the St. Lawrence widens into a narrow lake studded with the Thousand Islands, famous for their scenic beauty. The Thousand Islands Bridge, opened in 1938, spans the river between Collins Landing, New York, and Ivy Lea, Ontario. It comprises five separate bridges, and a roadway over four islands, totaling 8½ miles in length. On the Canadian shore of Lake Ontario, at the point where the river leaves the lake, 170 miles southwest of Montreal, lies Kingston, an important grain-transferring port. Throughout its length, from Lake Ontario to the gulf, the St. Lawrence flows past fertile plains and low hills merging into bluffs, with here and there an isolated peak of the Laurentians or the Green Mountains to break the skyline and add to the beauty of the picture.

GASPÉ PENINSULA, WHERE GULF AND RIVER MEET



The rocky headlands of the Gaspé Peninsula mark the mouth of the St. Lawrence River. This isolated part of Quebec, with its charming French villages and bold scenery, is a popular tourist resort. The Perron Boulevard encircling the peninsula opened it to the outside world in 1928. Above is the village of Percé, with Percé Rock and Bonaventure Island beyond.

The importance to Canada of the St. Lawrence River cannot be overestimated. The shortest freight route from the Great Lakes to Europe, it is the natural highway for exporting grain from the western United States and Canada, oil from the mid-western fields, lumber and pulp from eastern Canada. As a commercial route the river has, however, two drawbacks. First, its harbors and canals are frozen for five months of the year. Second, its channel is like an hourglass—deep and wide at both ends, shallow and narrow in the center. Freighters drawing more than 14 feet of water cannot enter the canals between Montreal and Lake Ontario, and so cargoes must be transshipped at Montreal and again at Kingston. For many years it has been proposed that Canada and the United States share the expense of deepening the river channel to 27 feet, and constructing new canals and locks which would permit the passage of ocean vessels to the heart of the continent. In the rapids above Montreal the river falls 224 feet, and the development of this tremendous potential electric power is an important part of the proposal.

In 1534 Jacques Cartier, commissioned by the king of France to explore the American coast, entered the Strait of Belle Isle but did not discover the river until on a second voyage in 1536. He named it the St. Lawrence to honor the saint on whose feast day, August 10, he arrived at the entrance. Cartier

was the pathfinder who penetrated as far as what is now Montreal, but he established no settlements.

This was left for Champlain, who in 1608 planted a colony on the site of Quebec, and between that date and 1616 explored the whole river system as far west as Lake Huron, taking possession of the country in the name of the king of France. By the treaty of Paris in 1763, however, practically the whole of the French claims to America east of the Mississippi were ceded to Great Britain. Under its rule the Canadian portion of this vast region, including the entire length of the river, still remains.

Historic ST. LOUIS—*Its* COMMERCE *and* CULTURE

SAINT LOUIS (*lo̤'ĭs*), Mo. On Feb. 15, 1764, Pierre Laclede Liguest, a French trader from New Orleans, established a post on the Mississippi River to promote fur trade with the Indians to the Northwest. The settlement lay on the west side of the "Father of Waters," a few miles below the mouth of the Missouri River. The Illinois River, about 30 miles to the north, was the highway to the Great Lakes region. And downstream some 125 miles was the mouth of the Ohio River, leading far toward the East. The location was a natural focus for the trade of the entire Middle West. Out of the little log fort with its cluster of dwellings has grown St. Louis—the largest city in Missouri and one of the nation's leading industrial and commercial centers.

The Rôle of Transportation in Its Development

In this growth, transportation played an important part. The city was the great river port of the Central Plains in the middle 19th century. Most of its trade was carried on by boat, and the levees were the busiest part of the city. River traffic declined after 1850, but the railroads brought still more business to the already thriving city. Today it is the second largest railroad center in the country.

Seven bridges cross the Mississippi River in the St. Louis region. Two are used exclusively by the railroads. Three are combined railroad and highway bridges, and two accommodate only vehicular traffic. Eads Bridge, completed in 1874, was one of the great engineering triumphs of its day. A work of beauty and power, it was designed and built by a St. Louis engineer, James B. Eads.

With the revival of river transportation in recent years the city has resumed its old position as a port. Fleets of steel barges ply south to New Orleans, north to St. Paul, to Chicago by way of the Illinois Waterway, and up the Missouri River to Kansas City. Lambert Field, the municipal airport, handles a growing air traffic. The city's "air conscious" businessmen financed Charles Lindbergh's flight to Paris in 1927 in the *Spirit of St. Louis*.

Industrial Giant of the Plains

As the prairies around St. Louis were turned into farms, the city marketed their products and distributed to them the manufactured goods of the East. It became a great horse and mule market, and large slaughtering and meat-packing plants grew up. With quantities of hides at hand and a growing market, St. Louis became a leading manufacturer of boots and shoes. The forests of the Ozark Plateau, southwest of the city, supply timber for an important lumber and furniture industry. The fur business started by Laclede and his trappers and traders still exceeds that of any other city in the world. Streetcars manufactured here operate in cities throughout the country. Clothing, iron and steel goods, flour, drugs, chemicals, airplanes and airplane parts, and explosives are among the varied products. Power for mills and factories comes from the coal beds of southern Illinois, the Mid-Continent oil fields, and the hydroelectric plants at Keokuk, Iowa, and Bagnell, Mo.

The New City and the Old

The city extends along the river for about 20 miles, and westward for almost 10 miles over rolling uplands which rise to a maximum height of 900 feet above sea level. Streams flowing into the Mississippi have cut valleys which provide natural routes for the railroads. Factories and warehouses have grown up beside the railroads in the valley bottoms, and the retail and residential districts occupy the upper levels. East St. Louis, just across the river in Illinois, is closely associated with the Missouri city. The corporate limits

A PANORAMIC VIEW OF ST. LOUIS' CIVIC CENTER

The civic activities of St. Louis center around its Memorial Plaza. The low, square building, left foreground, is the Soldiers' Memorial. To the right in the background towers the Civic Courts Building. On its right is the Federal Building. The old City Hall and the Municipal Courts Building face the Soldiers' Memorial. At the extreme right is the Municipal Auditorium.

of St. Louis were set by the Missouri legislature in 1876 at 61.4 square miles. The city's influence, however, extends throughout its metropolitan area of more than 800 square miles.

The old French town, known as Laclede's Village, extended along the river front between the present Municipal and Eads bridges. In this little village the vast territory of Upper Louisiana was formally transferred from France to the United States in 1804. On the site of the first log church is a magnificent cathedral, consecrated in 1834. Adjoining it is the courthouse in which the famous Dred Scott trial was held. From the stone auction block at the east door slaves were sold before the Civil War. On the river front stands Old Rock House, the oldest building in the city. Forty square blocks, occupying the site of the original village, have been purchased by the United States National Park Service for the Thomas Jefferson Expansion Memorial. All buildings save the historic old structures have been demolished, and the area is being made into a park with a monument to Jefferson and the Louisiana Purchase.

The Civic Center and the Parks

On the bluffs above the river front is the skyscraper business district. A civic improvement plan, adopted in 1923, has remade this part of the city at a cost of more than $100,000,000. About $25,000,000 was spent in widening some 50 miles of streets. A Memorial Plaza covering six blocks is the center around which are grouped many fine public buildings, some old and some new.

West of this Civic Center stands the Union Station. Blocks of drab tenements were razed to create the broad plaza now facing it. In this plaza is a beautiful fountain, "The Wedding of the Rivers," designed by the Swedish-American sculptor Carl Milles. Another point of interest is Jefferson Barracks, on the river front in the southern part of the city. An army infantry post for more than a century, it is now an air corps training center. Eugene Field's boyhood home, near the Eads Bridge, is owned by the city.

Forest Park, covering about 1,400 acres, is west of the business district. The Louisiana Purchase Exposition of 1904 was held here. In the park is the Jefferson Memorial Building, which contains the original documents of the Louisiana Purchase; the original papers of the Lewis and Clark Expedition, which started from St. Louis; the trophies given to Charles Lindbergh after his flight to Paris; and relics from the Indian mounds of the region which gave St. Louis the nickname "the Mound City." The Zoölogical Park was among the earliest of the cageless type in the United States. In Forest Park are also the Art Museum; an outdoor municipal theater for summer opera, which seats 10,000 persons; the Jewel Box, a conservatory of modernistic design; and the statue of St. Louis, symbol of the city. Southeast of Forest Park, adjoining Tower Grove Park, is the Missouri Botanical Garden, popularly known as Shaw's Garden. It has one of the largest and most notable collections in the world.

These lovely parks provide the background for a unique celebration—the Festival of the Veiled Prophet of Khorassan, held in mid-October since 1878. The mysterious Prophet, whose identity is never known, rules with his Queen, Court, and Order of Knights, over the two-day carnival with its parade and final ball. Based on the motto that "laughter keeps step with progress," the gay, colorful affair attracts many visitors to the city.

Economic and Cultural Growth

St. Louis was named for the patron saint of Louis XV, king of France. From 1770 to 1800 the city was the capital of the Spanish territory of Upper Louisiana. Following the Louisiana Purchase, when the West was opened to settlement, St. Louis grew with the nation. The city was incorporated in 1822. German immigrants, who came in large numbers in the first half of the 19th century, profoundly influenced the city's cultural development. They sponsored a symphony orchestra and other musical societies and they helped to establish in St. Louis in 1873 the first public kindergarten in the United States. The city is the seat of Washington University; St. Louis University (Jesuit); the Principia (Church of Christ, Scientist); and Concordia Theological Seminary (Evangelical Lutheran). Population (1940 census), 816,048.

SAINT-MIHIEL (*săn-mē-yĕl'*), FRANCE. In the summer of 1918, the Allied armies began to beat back the Germans, and the commander in chief, Marshal Foch decided upon a huge attack against the northern and southern flanks of the main German positions. The southern attack was entrusted to the American forces under General Pershing.

Their task was to paralyze the central portion of the German armies by seizing the vital rail and supply centers at Sedan and Metz. To do this, however, called for enormous strength in men, and mountainous quantities of ammunition, food, and supplies, and the Germans were in a position to cripple the movement of supplies in the needed quantities. Ever since 1914, they had dominated the main railroad lines from France into Metz, and into Verdun in the north, from a wedge-shaped salient with its tip at Saint-Mihiel on the Meuse River. The Americans had to free these supply lines for their use before they could deliver their main attack.

To do this, General Pershing formed the American First Army under his command on Aug. 19, 1918, and began concentrating his forces for the blow. On the night of September 11, 500,000 men, including 70,000 French colonial troops, were ready to attack at daylight. After four hours of intense artillery bombardment, the infantry and tanks went over the top, and within a day they completed their task. (For map and details of the action, *see* World War of 1914-1918.)

The operation captured some 16,000 prisoners and 443 guns, at a cost of about 7,000 Americans killed and wounded. With the supply lines freed, the Americans were able to begin the decisive battle of the Meuse-Argonne on September 26 (*see* Argonne Forest).

SAINT PAUL, MINN. At the head of navigation on the Mississippi River is Minnesota's capital and second largest city. St. Paul lies on both sides of the river, which here makes a double curve like a letter S tipped

over on its face. On the west it adjoins its larger "twin city," Minneapolis.

St. Paul grew up around Fort Snelling, which was established in 1819 to protect the headquarters of the American Fur Company. Its site, where the Minnesota River flows into the Mississippi, had been selected in 1805 by Zebulon M. Pike, explorer and Army officer, who recognized its military importance as a gateway to the Northwest. Pig's Eye, the nickname of its first settler, the trader Pierre Parrant, was also the popular name for the settlement until Father Lucien Galtier renamed it St. Paul upon building the first church in 1841.

Railroads Bring Prosperity

The early prosperity of the city and of the entire Northwest was due in large part to the dynamic James J. Hill, railroad and empire builder, who came to St. Paul as a young man in 1856 (*see* Hill, James Jerome). With the advent of railroads St. Paul grew rapidly as a distributing center. By 1870 it had some of the largest wholesale and jobbing houses in the country. In recent years traffic on the Mississippi has revived with the construction of government dams and locks to ensure a nine-foot channel.

The varied list of manufactures includes dairy products, refrigerators, hoists and derricks, and abrasives. The Ford Motor Company has a large assembly plant here, and the railroads have large repair shops. Printing and publishing, including the production of calendars and other advertising specialties, is another large industry. The stockyards and packing houses of South St. Paul, an adjoining suburb, are among the largest in the nation.

The City on the Hills

The business section and much of the residential area of the city lie on the north bank of the river, where the bluffs are lower and less abrupt than on the south bank. Third Street, the main business thoroughfare paralleling the river, has been transformed into a broad plaza and parkway named Kellogg Boulevard for the statesman Frank B. Kellogg, long a resident of St. Paul. On this boulevard is the towering City Hall and County Courthouse, erected in 1931–32 at a cost of $4,000,000. The Fourth Street lobby of the building is known as the War Memorial Concourse. Its most impressive feature is the onyx statue of the Indian god of peace by Carl Milles, Swedish-American sculptor. Also on Fourth Street are the imposing Public Library and the James Jerome Hill Reference Library, which are housed in the same building.

The State Capitol, on a hill northwest of the river, was designed by the famous architect Cass Gilbert, who grew up in St. Paul. Sculptures and murals by the nation's foremost artists adorn it (for picture, *see* Minnesota). Near the Capitol are the State Office Building, the Minnesota Historical Society, and the St. Paul Institute (a museum of science).

Two lakes within the city limits, and the wooded bluffs on both sides of the Mississippi afford attractive settings for parks and boulevards. On Summit Avenue, one of the finest residential streets, is the St. Paul Cathedral. Holman Municipal Airport is on the south bank of the river within five minutes' driving distance of the business district.

St. Paul is the seat of the University of Minnesota's College of Agriculture; Hamline University (Methodist); Macalester College (Presbyterian); and the Roman Catholic College of St. Catherine, St. Thomas College, and St. Paul Seminary. The good transportation, the fine hotels, and the great municipal auditorium attract many conventions. Two events which bring great throngs are the State Fair, held every fall, and the annual Winter Carnival.

The city was incorporated in 1854 and became the capital of the new state in 1858. It adopted commission government in 1912. Population (1940 census), 287,736.

SAINT VALENTINE'S DAY. For centuries February 14 has been observed as Saint Valentine's Day. Chaucer and other medieval writers speak of it as the day when the birds mated. In Shakespeare's 'Hamlet' one of Ophelia's songs is:

Tomorrow is Saint Valentine's day
All in the morning betime,
And I a maid at your window,
To be your Valentine.

Traditionally, February 14 is a day for lovers. In medieval times young people in England, Scotland, and France used to assemble on Saint Valentine's Eve. They drew names by chance from an urn. Each person then became the "valentine," that is, the special friend of the one whose name he drew. It is still customary on this date to exchange gifts, many of them heart-shaped, as an expression of affection. Friends send candy, flowers, or even more elaborate gifts, and greetings.

In the United States the day is celebrated in schools with plays, pageants, dances, or special music. In many schools valentines are made in the art department, or special time is set aside from the regular school work for that purpose. There are endless opportunities for originality. Simple and inexpensive valentines can be made from Christmas wrappings, paper doilies, pictures of flowers in magazines, and from the colored linings of used envelopes. Just as in medieval times, all the greetings are often placed in a valentine box.

Of the several saints named Valentine, the most important were a Roman priest and a bishop of Terni, both of whom were executed in Rome in the third century. That their feast day is also the day set aside for lovers seems to be merely a coincidence. The Roman festival Lupercalia, which occurred on February 15, may be related to the modern celebration.

SAL'ADIN (1138–1198). "Before I saw his face I was sore afraid, but now that I have seen him I know that he will do me no harm"—these are the words of a Crusader who was taken prisoner and brought before Saladin, sultan of Egypt and Syria, the noblest foe that the knights of the Cross ever encountered. By the Mohammedans he was revered as a wise and clement ruler, a leader who was able to unite his people and turn back the tide of Christian invasion, and as a man who embodied the highest virtues and ideals of Islam.

His leadership came at a time when it was sorely needed, for the Mohammedan world, without political unity, was sinking into decay. Bit by bit, since the First Crusade had won Jerusalem for Christendom, the empire of the Seljukian Turks, who held the temporal power of Islam, had been falling apart. It was not the strength and zeal of the Christians so much as the weakness of their foes that had kept the Christian Kingdom of Jerusalem alive.

The original name of this leader was Yusuf ibn Ayyub, and Salah-ed-din (or Saladin) is merely the title given him, meaning "Honor of the Faith." He came of that strong and warlike race of Asia Minor, the Kurds; and his father was governor, under the Seljukian Turks, of the province of Tekrit in Armenia. Saladin himself early rose to prominence. He was sent by Nurredin, the Seljuk Sultan of Syria, on an expedition to Egypt, which resulted in the winning of that land for Nurredin and eventually in the appointment of Saladin as vizier of Egypt. When Nurredin died rebellion broke out against his young heir, and Saladin overran and gained control of Syria. The calif of Egypt having also died, Saladin was now the most powerful ruler in Islam, and the calif of Bagdad recognized him as the sultan of both Egypt and Syria.

Saladin's great purpose was to win back for Islam the lands embraced in the Kingdom of Jerusalem; and when in 1187 one of the Christian leaders broke faith, he seized the opportunity to proclaim a Holy War. Gathering forces from all parts of Egypt, Syria, and Mesopotamia, he overran Palestine. Jerusalem was besieged and captured (1187), and the entire Christian kingdom, except Tyre, was conquered. In his taking of Jerusalem, as in all his acts, Saladin showed himself chivalrous and merciful. There was no such slaughter of non-resisting inhabitants as had marked the taking of the city by the Crusaders almost a century before. The captives were set free on payment of ransom, and many of those who were too poor to pay were given their freedom through charity.

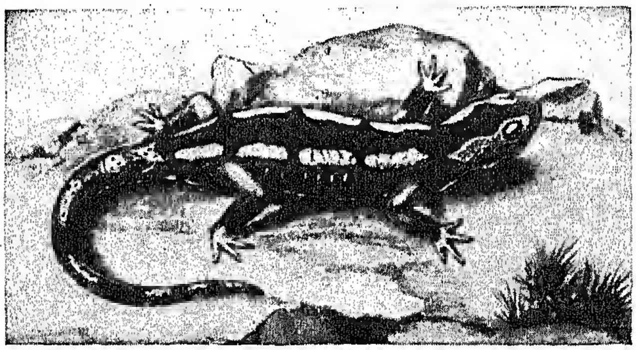
It was to regain Jerusalem that the Third Crusade was undertaken by the Christian rulers of Europe, notably Philip Augustus of France and Richard I of England. But the struggle ended with Jerusalem and all of Syria, except the coast line, in the hands of Saladin. The treaty of peace signed in 1192, however, provided that Christian pilgrims might freely visit the Holy Sepulcher at Jerusalem.

Saladin was a favorite figure in medieval romance, and Sir Walter Scott in 'The Talisman' has given us a noble picture of his chivalry and faithfulness to his word, shown particularly in his dealings with his great adversary, Richard the Lion-Hearted.

SAL'AMANDER. A small salamander or newt hiding under a log or swimming in a stream may seem insignificant to most of us. But to biologists it is an animal of special interest, as a sort of "connecting link" between water-dwelling fish and land animals such as reptiles, birds, and mammals.

A common salamander, when full-grown, is a land animal; it has lungs for breathing air and legs for walking. But in the breeding season it lays tiny jelly-covered eggs, like those of a fish, in some stream. The egg hatches into a fishlike tadpole, which has gills for breathing in water. For several months the tadpole lives in water; then it develops legs and lungs, and begins to live on land. This change from life in water to life on land is an important feature in the theory of evolution.

"FIRE SALAMANDER" OF EUROPE



It was not the bright yellow spots on its shiny black coat which earned for this little creature the name of "Fire Salamander," but the fable that it could live in fire.

Even on land, however, the salamander's skin remains moist and slimy, as it was in the water. The moist skin absorbs oxygen, either from the air or from the water. It also secretes a noxious substance which helps repel attack. This moist, cool skin helped create the ancient belief that salamanders could live in fire. Actually the animals were brought indoors in firewood, and were found near the fire. But people thought they came *from* the fire, and escaped burning because of their cool, slimy skin.

Common Salamanders and Newts

The United States has more than 60 species of salamanders and related animals. A common example is the tiger salamander (*Ambystoma tigrinum*). It has yellow spots on its black back, and it may grow to be nine inches long. On land it lives under stones or logs or in burrows, and it feeds at night on worms, insects, and other small creatures. The spotted salamander (*Ambystoma maculatum*) and the European fire salamander (*Salamandra maculosa*) are like the tiger.

Newts are small salamanders which have a flattened tail for swimming. They live in water even when grown, eating fish, shellfish, insects, and worms. The eastern spotted newt is olive or yellow green, with red spots. The tadpoles, called red efts, often crawl about on land in wet weather. A western species of newt is often called a water dog. The eastern mud puppy retains gills and lives in water all its life.

The ugly hellbender (*Cryptobranchus alleghenienss*) of the Eastern and Central states has an extremely loose, wrinkled skin, and breathes through it and the blood vessels in the throat, without using its lungs. It may be two feet long or more, and it is a voracious fish eater. In contrast to this water dweller, many tree and forest salamanders, as well as the burrowing "mole" types, lay eggs in damp places on the land. The young develop lungs before they hatch from the egg. In a few species, the eggs hatch within the mother's body.

Salamanders That Never Grow Up

Many species of the salamander never change completely to the land-dwelling form. This happens to the tadpole of the tiger salamander in mountain lakes of Mexico and the western United States. It lives its entire life and even breeds while still a tadpole. These permanent larvae are called *axolotls*, the Mexican native name. They fail to develop because the water lacks iodine. If this is supplied or if they are driven from the water, they become normal adults. Many cave-dwelling salamanders remain blind and fail to develop lungs.

Salamanders are grouped with frogs, toads, and other creatures as *Amphibia*. This class includes vertebrates which undergo *metamorphosis*, or change from a water-dwelling tadpole to a land-dwelling adult. The salamanders form the order *Caudata* or *Urodela*, meaning "with tails."

SAL'AMIS. The great naval battle of Salamis, one of the decisive battles of the world, was fought between the Greeks and Persians in 480 B.C., in the narrow strait between the island of Salamis and the coast of Attica. The Persians under King Xerxes were decisively defeated, and Europe was saved from Asiatic conquest. The chief credit for this result belongs to the cunning Athenian statesman Themistocles, who not only induced his fellow citizens to place their reliance in the "wooden walls" of the Athenian triremes, but also by a trick prevented the Peloponnesian vessels from retiring and so brought on the battle in the narrow waters where alone the Greek navies might hope to triumph over the giant fleet collected by Xerxes. (*See* Persian Wars.)

SALMON. For its beauty, its "gaminess," its value as human food, and the interest of its strange life history, the salmon is distinguished among fishes.

The typical salmon, hatched in fresh water, "runs away to sea" under the urge of some mysterious instinct when a year or two old. An instinct just as imperious brings the fish swarming home by the thousand about two years later, to spawn in fresh water. They come in such numbers that sometimes they fairly choke the rivers. A count made one year during a salmon run from June 14 to August 10 showed more than 2,500,000 fish ascending Wood River, Alaska, which is not one of the largest salmon rivers of the Pacific coast.

The homing salmon swims upstream sometimes at the rate of 15 miles and more. It leaps up waterfalls six and eight feet high; it ascends rapids of even greater height. Nothing but death can prevent it from reaching its desired haven.

It leaves the ocean in splendid condition, a large beautiful fish with dark back and silvery black-spotted sides, and with an average weight of from 4 to 25 pounds according to the species, and an occasional weight in some species of 45 to 100 pounds. It eats nothing after entering fresh water. As it fiercely fights its way back home, hardship and privation gradually disfigure and deform it. Slimy, emaciated, and discolored, it becomes a hideous object, with distorted head and body, mutilated tail and fins, and skin from which scales have disappeared, and often scarred and torn or blotched with fungus. The salmon of some coasts may live to descend the rivers after spawning; those of the Pacific coast die exhausted on or near the spawning grounds. In Norway, Sweden, Maine, and Quebec there are "landlocked salmon" which never reach the sea, but spend their adult life in lakes, ascending streams to spawn.

The salmon fry are at first queer shapeless little monsters, known as "alevins," each with a comparatively huge yolk-sac under its body. For about six weeks the alevin hides among the stones, eating nothing until the yolk-sac is nearly absorbed. Then it puts on a dark-banded red-spotted coat, so unlike that of the adult salmon that the "parr," as the young fish is termed, was long believed to be a distinct species. When ready to go to sea it puts on a silvery coat and is known as a "smolt." In the sea it becomes a "grilse" until it reaches maturity.

The salmon is essentially a cold-water fish, confined to the Northern Hemisphere. Salmon swarmed during the runs in New England rivers when the first white settlers arrived, and it is said that salmon, with bass and shad, "more than half supported the province" in early days until seine fishing and damming of the rivers diminished their numbers. The Pacific salmon is one of the most valuable fish in the world today. The salmon pack of the three Pacific coast states, Washington, Oregon, and California, has an average value of over $12,000,000 annually; that of Alaska is more than three times as large.

Several species of salmon feed in the Pacific and breed in its rivers. Each goes by many names. The blueback or sock-eye, a small fish weighing on the average about five pounds, brings a high price because of the fine color and flavor of its flesh. The chinook, quinnat, or king salmon attains the largest size. Its weight averages from 20 to 25 pounds, and specimens weighing 100 pounds have been taken. It is the gamest of them all, and a favorite with sportsmen. These two species, whose bright red flesh does not fade on cooking, formerly made up the bulk of the catch. Year after year they were packed in increasing amounts, until constant over-fishing diminished their numbers.

The humpback, smallest of Pacific salmons, and the chum or dog salmon, both with the pink flesh formerly scorned by the canner, now exceed their red-fleshed cousins in the annual pack. They, too, are becoming scarcer. The silver salmon has bright

red flesh which fades on cooking. Another Pacific salmonoid fish is the white-fleshed salmon trout, steelhead, or winter salmon.

The Pacific salmon are caught by purse seines, gill nets, beach seines, hooks, and traps. The Columbia River, Puget Sound, and Bristol Bay, Alaska, are the centers of the American industry. The canneries are located at the fishing grounds near the mouths of the rivers. In most canneries Chinese hand labor is now replaced by the "iron chink." This machine removes the head, tail, fins, and viscera. Then the fish is washed and cut into pieces. Filling machines place salt and fish in the cans, while the vacuum closing machine draws the air out of the can and rolls the cover on air-tight. The cans are cooked in steam retorts at 240° F. for 90 minutes. The world's salmon pack in 1934, up to that time the largest in the history of the industry, was 12,220,000 cases. (*See also* Fish Culture; Fisheries.)

Salmon belong to the family *Salmonidae* ("Leapers"), which also includes trout and whitefish. They are cold-water fish, found only north of the 40th parallel, except for a few which have been introduced into the streams of New Zealand and Australia. There are two genera, the Atlantic salmon, *Salmo salar*, and the Pacific salmon, *Oncorhynchus* ("hooknose"), of which there are five species. The name "salmon trout" is applied to the European sea-trout and to various fresh-water salmonoid fishes, as well as to the Pacific coast steelhead trout.

SALONIKI (*säl-ō-nē'kē*), GREECE. To the north and east a rampart of bare hills that happily hide the naked wilderness inland; to the south and west the blue waters of the safe and roomy harbor, in which ride the ships of a score of nations—such is the superb position of Saloniki, at the head of the Aegean Sea. This ancient city—the Thessalonica of the Bible, to whose converts St. Paul addressed his two Epistles to the Thessalonians—is the most important seaport of the northern Aegean, and served during the World War of 1914–18 as the base of Allied operations in Macedonia.

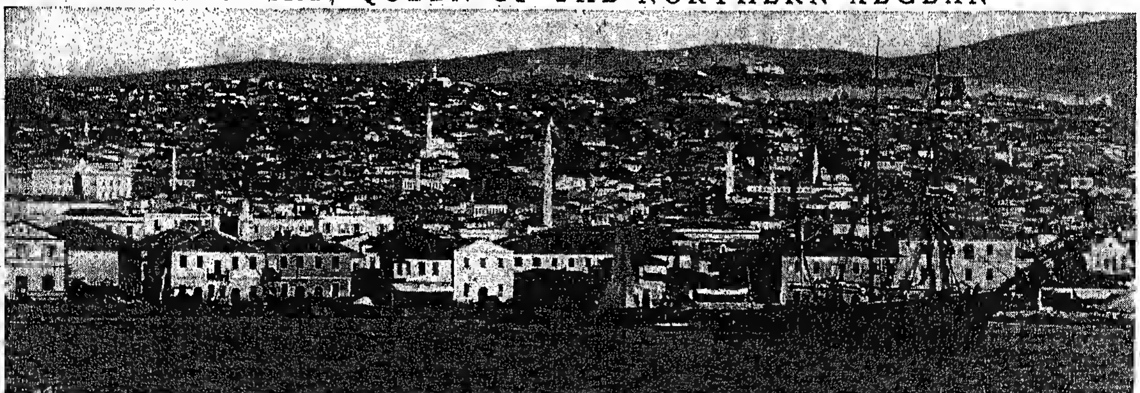
Saloniki (also written Salonika and Thessalonike) is still girdled by its medieval wall, forbidding and solid, climbing to the old citadel which crowns the heights at the back of the city. From the citadel one looks out over old Saloniki—a maze of rambling crooked little alleys, mysterious and shadowy. Mere slippery cobbled paths, most of them are, sloughing the day's accumulation of filth into the open drain which meanders down the edge. Blank walls line them, with sometimes an iron-barred window, and stout-doored entrances to sleepy stone-flagged courtyards, where a sage-green sycamore is silhouetted against the blue wash of the wall beyond. Unexpected galleries and gables that lean far out across the narrow way throw jagged shadows over groups of gossiping women—some in long black Turkish dominoes or cloaks, others in the picturesque peasant costumes of Greece, of Albania, and of Bulgaria.

Lower down, the spires of Christian churches and the minarets of splendid Mohammedan mosques of great antiquity rise above the monotonous line of one- and two-storied houses, and the stores, clubs, and theaters of the shopping district near the Quay. The "Street of the Vardar," which cuts the town in two at the foot of the hill, is a piece of the old Roman road from the Adriatic to the Golden Horn, and earlier still was the "Royal Way" of the ancient Macedonian kings.

Near its eastern end this street is spanned by a triumphal arch erected in the days of the Roman Empire. All day long American street-cars rumble back and forth beneath it. The dignified fathers of Israel in long fur-lined gabardines rub elbows with kilted Greek peasants in tight white trousers tasseled under the knees, or booted Montenegrins with hanging sleeves. Arrogant Bulgars, in brown homespun and *opinskis*—rough sandals of untanned leather—stare at tall Albanians in white or black frieze and white skull caps over one ear.

Saloniki's past is long and tumultuous. It has survived centuries of sack and massacre, siege and revolution. It has had a dozen masters. Its present foundations rest upon the ruins of an ancient and prosperous city, founded by a king of Macedonia in 315 B.C. and named for the half-sister of Alexander the

SALONIKI, QUEEN OF THE NORTHERN AEGEAN



More than 2,000 years have swept over Saloniki; fire destroyed two-thirds of the city in 1917; but nothing can deprive it of its splendid situation and magnificent harbor which make it the chief seaport of the Balkan Peninsula.

Great. Xerxes stopped here to take stock of his men and equipment before advancing into Greece. For nearly 500 years it was in the hands of the Turks. The Treaty of Bucharest (1913) gave Saloniki to Greece. In 1925 Greece made it a "free zone," to give port facilities to other Balkan states. In 1941, when Greece was resisting invasion, the city was bombed by German and Italian planes. Further destruction was wrought by the Greeks themselves as they abandoned their city to the invaders. Population, about 235,000.

SALT—*Preservative* of FOOD *and* LIFE

The Wonderful Substance that Seasons Bread and Oceans, Blood and Tears—The Various Kinds of Salts

SALT. What is it? "Salt," said a little boy, "is what makes your potato taste bad when you don't put any on it." He was talking about common or table salt, a substance the tremendous importance of which is rarely appreciated, because it is so common.

To chemists, however, a "salt" means any one of a class of substances of which our table salt is a type—a substance formed by the reaction of an acid with a base (*see* Acids and Alkalies). Bring sulphuric acid (which is a partnership of sulphur, hydrogen, and water) into contact with soda lye or caustic soda (which is a partnership of sodium, hydrogen, and oxygen), and presto, change! Some of the hydrogen and oxygen atoms elope in the form of water, while the forsaken sodium and sulphur strike up a new partnership with the few faithful oxygen atoms to form sodium sulphate—a salt.

WHAT COMMON SALT WILL DO

A little rubbed on the cups will take off tea stains.

Put into whitewash it will make it stick better.

As a tooth-powder, it will keep the teeth white and the gums hard and rosy.

Salt is one of the best gargles for sore throat, and a preventive of sore throat if taken in time.

Salt and water cleans willow furniture; apply with a brush, and rub dry.

Salt and water held in the mouth after having a tooth pulled will stop the bleeding.

Two teaspoonfuls of salt in half a pint of tepid water is an emetic always on hand, and is an antidote for poisoning from nitrate of silver.

Neuralgia of the feet and limbs can be relieved by bathing night and morning with salt and water as hot as can be borne. When taken out, rub the feet briskly with a coarse towel.

Salt and water is one of the best remedies for sore eyes, and if applied in time will scatter the inflammation.

Silk handkerchiefs and ribbons should be washed in salt and water, and ironed wet, to obtain the best results.

Iodized salt is used to prevent goiter.

Hemorrhages of the lungs or stomach are often checked by small doses of salt.

The chemical name for common salt is "sodium chloride." It occurs in nature both in beds or strata (when it is called "rock-salt"), and in solution in water. Aside from the sea and salt lakes, the underground waters of many regions contain salt. The salt of commerce is partly mined from the beds of rock-salt, and partly extracted from salt waters. In the latter case the brine may be natural, as in the case of the sea, salt lakes, and salt wells; or it may be artificial. In the case of artificial brines, fresh water is allowed to flow over beds of salt, and from the resulting solution salt is extracted. The salt water may be evaporated in the open air by the sun's rays, or artificial heat may be used. Flaky, coarse salt, used by packers, is evaporated slowly. Fine, square-grained table salt is made by rapid boiling in vacuum pans. Bicalcium phosphate may be added to prevent moisture absorption and keep it running freely.

Beds of rock-salt represent deposits made on the bottoms of salt lakes, lagoons, and the like. In some lakes, as Great Salt Lake, Utah, such deposits are being made at the present time. Similar deposits have been made in the past—some of them millions of years ago—and subsequently buried by layers of sand, mud, etc. Sometimes such beds are hundreds of feet thick. The salt in solution in underground waters may have been derived from salt beds over which the waters, seeping in from the surface, have passed. Some of the natural brines underground may represent sea-water with which the sediment was originally filled and which has never been drained out.

In the Carpathian Mountains, at Wieliczka, Poland, are the world's most famous salt mines. They form an underground city with 65 miles of galleries, and 30 miles of railroad, reaching a depth of 1,000 feet.

The thickest salt beds of the United States, so far as now known, are on the coast of Louisiana, on Avery Island. Other valuable beds have been tapped in the chief producing states—Michigan, New York, Ohio, Kansas, Louisiana, Texas, and California. In California, salt is taken from the sea, and in Utah from Great Salt Lake. The United States is the greatest salt producer, but Great Britain, Russia, Germany, France, India, and China yield large amounts.

Sodium and chlorine are needed in our bodies and in the bodies of all animals, and since our food does not contain much of these elements, we use salt for seasoning. Deer and other wild animals resort to salt "licks." Great cubes of compressed salt are placed in pastures for domestic animals.

Salt was used to season and preserve food long before the beginning of recorded history. Where there was no supply near at hand it was brought from great distances, and thus became one of the most important articles of early commerce. One of the oldest roads of Italy was called the *Via Salaria* (salt road) because it was the route by which salt was transported. The caravan trade of the Sahara is still largely a trade in salt. In some remote parts of the world, such as Central Africa, salt is even today one of the most

prized of luxuries. Cakes of salt have even been used as money in Ethiopia and other remote regions.

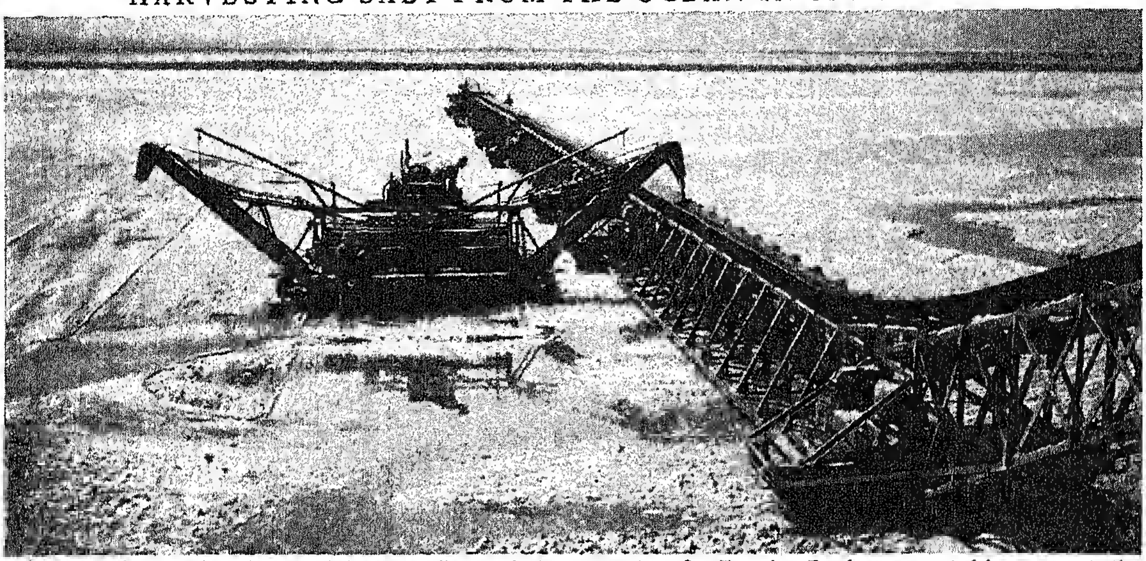
Salt was so valuable in early times that it gives us our word "salary," from the Latin *salarium*, meaning "salt money"—the allowance given Roman soldiers to buy salt. Among the ancients, to "eat salt" with a man was to create a sacred bond of friendship, and this is so with some oriental peoples today. In the Middle Ages one's social rank was shown by whether one sat above or below the salt at table. High taxes on salt were one cause of the French Revolution; and the modern unrest in India was brought to a crisis by the British monopoly on salt.

Large quantities of salt are used in the meat-packing and curing industries. From salt is made sodium carbonate (Na_2CO_3), indispensable in the manufacture of glass and soap, as well as sodium hydroxide, chlorine gas, hydrochloric acid, bleaching powder and sodium sulphate, all of which have important uses in industry and medicine. Salt cake is sodium sulphate formed in the manufacture of the carbonate. Crystallized sodium sulphate is Glauber's salt, the chief medicinal agent in the mineral waters of Karlsbad. The "hypo" of photography is sodium thiosulphate.

Epsom and Rochelle Salts

Iodized salt, which is common salt with a small amount of iodine compound added, is valuable in the treatment of goiter, and is used in regions where goiter is prevalent. Epsom salt, found in most households, is a hydrous sulphate of magnesium. It gets its name from Epsom, England, where it is found in the water of a spring. Seidlitz powders or Rochelle powders are drugs composed of tartrate of soda and potash, mixed with bicarbonate of soda and wrapped in a blue paper, and powdered tartaric acid wrapped in a white paper. When the contents of the two papers are dissolved separately in water and then poured together, the effervescing mixture is drunk as a mild aperient.

HARVESTING SALT FROM THE OCEAN IN CALIFORNIA

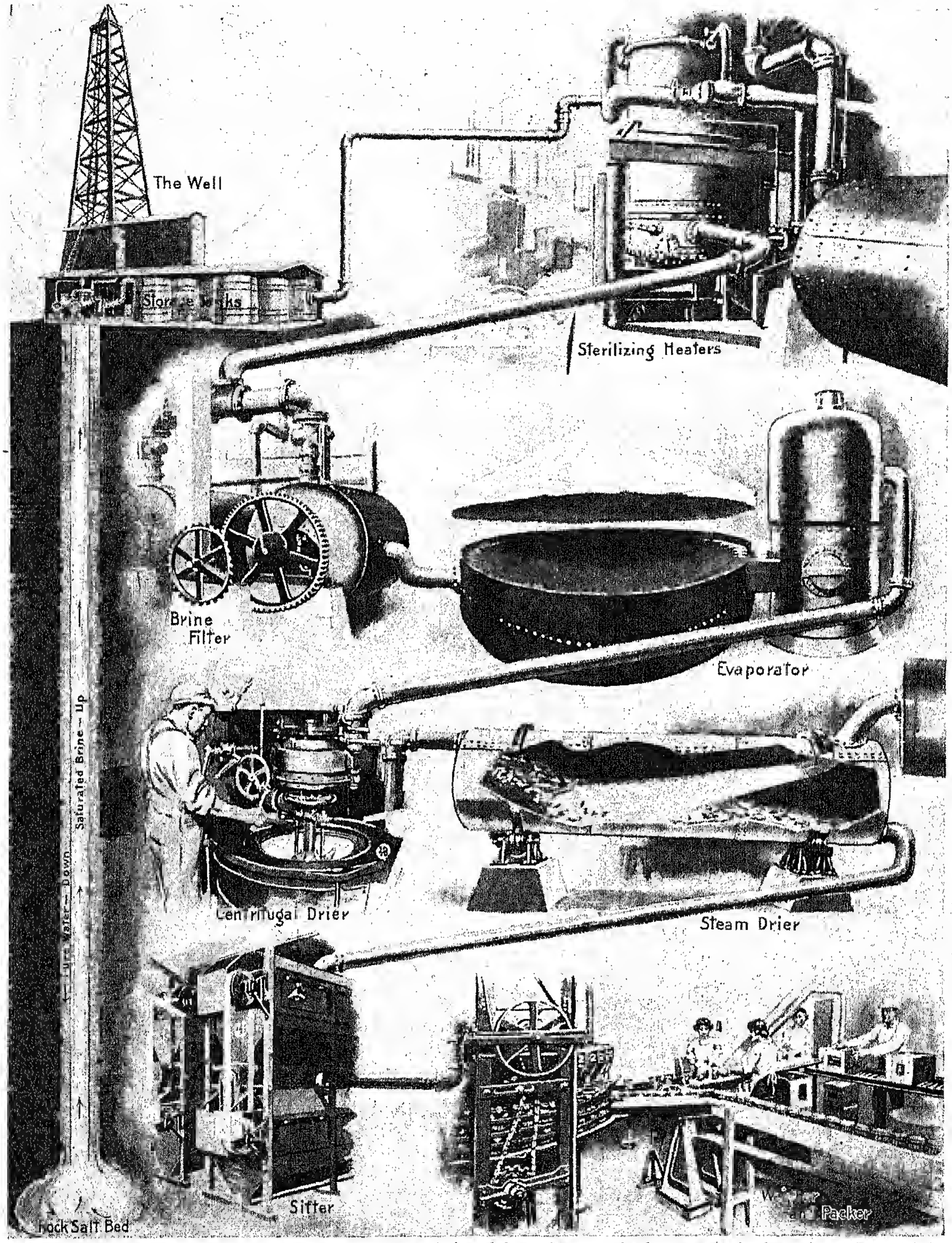


This mammoth tractor is gathering salt from a settling pond where water from San Francisco Bay has evaporated for seven months. It drops its giant left arm—a suction dredge—and sucks up the thick salty residue. This brine is pumped through the spout in its right arm on to an endless belt that runs over the movable pier, on its way to be refined into the product we use to season our food.

SALT LAKE CITY, UTAH. In 1847 Brigham Young led a band of Mormons westward across the plains and mountains to seek a new home free from persecution. When the wanderers came out on the western side of the mountains overlooking the valley of the Great Salt Lake, Young exclaimed, "Here we will stop and build our city." Today Salt Lake City is the leading commercial city of the United States between Denver and the Pacific coast, and the capital of Utah. This city, noted as the headquarters of the Mormon organization, has a dry healthful climate, being situated over 4,000 feet above sea level. To the south and east rise the snow-capped peaks of the Wasatch Mountains, while to the northwest a level stretch of country extends 12 miles to the shores of Great Salt Lake. The wide streets, many of which are bordered with trees freshened by streams of running water from the neighboring mountains, the well-kept gardens surrounding the residences, and the extensive parks aid in making the city attractive.

In the center of the city, surrounded by beautiful grounds, are situated the chief buildings of the Mormon church. The Tabernacle, a large oval building which seats 8,000 people, is noted for its remarkable acoustic properties and the large pipe-organ it contains. This building and also the Assembly Hall, which is devoted to divine service, are open to the public. Only Mormons, however, are admitted to the Temple, which is an imposing granite structure used for marriage, prayer, and baptism. Other buildings of note in the city are those of the University of Utah,

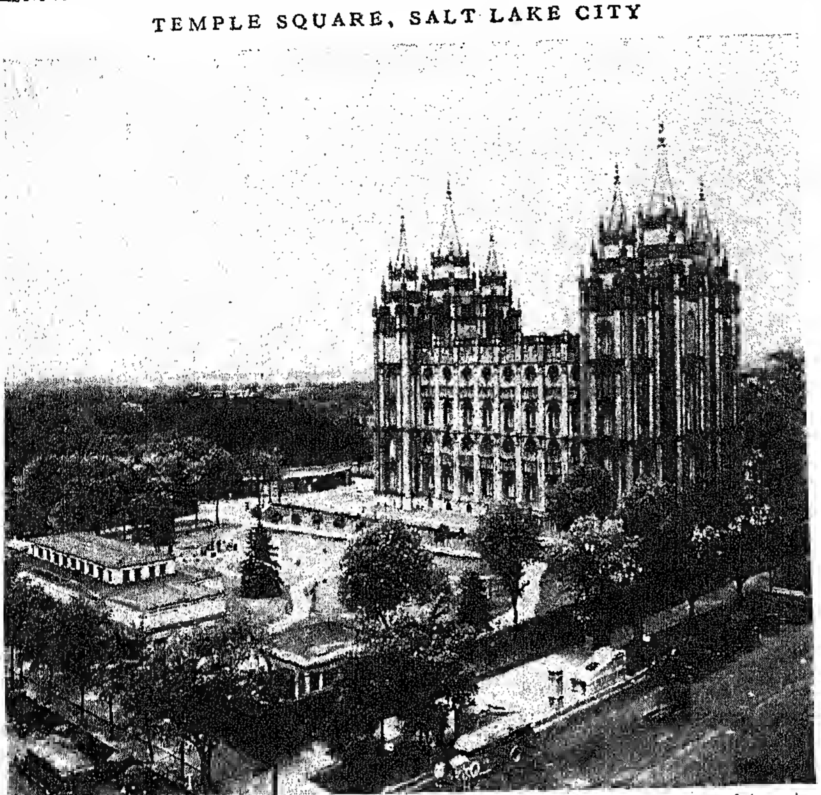
HOW THE "SALT OF THE EARTH" REACHES YOUR TABLE



A salt well has two pipes, one within the other. Pure water is forced down the outer pipe into a cavity in the rock salt bed, and the saturated brine is forced up the inner pipe by the pressure. The brine is then forced through a series of heaters, which precipitates the gypsum, and this gypsum is removed in gravel-laden filters. Evaporators then get to work on the purified brine to form the salt grains. These are next treated in centrifugal driers, which revolve at high speed and drain off most of the water through fine screens. All remaining moisture is removed in steam driers, which revolve slowly on an inclined plane, while a jet of heated air plays on the descending salt. After the fine flakes have been sifted through copper-screened bolters, the finished salt is automatically weighed and packed in containers ready for kitchen use.

a coëducational institution, the city and county building, the museum, the exposition buildings, and the huge warehouses of Zion's Coöperative Mercantile Institution. The street railway system is excellent.

TEMPLE SQUARE, SALT LAKE CITY



To the right is the great many-spired Temple, which none but Mormons are allowed to enter. To the left is the low spreading dome of the Tabernacle, the chief place of worship for the Mormon people. It is world-famous for its huge pipe-organ

Salt Lake City, through its central position, has become an important air line junction point, and a trade center not only for all of Utah, but also for parts of Idaho, Wyoming, and Nevada. It is a leading wool and cattle market, and its trading territory has numerous beet sugar and canning factories, dairies, flour mills, and smelters. The principal manufactures include salt, radio loudspeakers, candy, soap, cement, brick; foundry and machine shop products.

The original barren plain, by proper irrigation, has been made a garden spot. At first the growth of the city depended upon the inflow of Mormon converts from Europe and America, but later the mines and industries attracted the "Gentiles" (non-Mormons), who now form about half the city's population, which numbers (1940 census) 149,934.

SALTPETER. Ordinary gunpowder and fireworks depend for their explosive action in large part upon the saltpeter which they contain. To the chemist common saltpeter is known as "potassium nitrate," and he will tell you that its chemical symbol, which shows what it is composed of, is KNO_3. (*See* Chemistry.) He will also tell you that it forms colorless six-sided crystals, that its taste is cooling and very salty, that it dissolves in water but not in alcohol, that it is used in many ways besides in fireworks and gunpowder, and that it is found naturally in the soil of many countries, and especially in the caves of Kentucky, Virginia, and Indiana.

Common saltpeter, however, is usually manufactured from another form which is found in Chile (South America) in great beds, sometimes 10 feet thick, lying in an area 450 miles long by 5 to 40 miles wide. This is called *sodium nitrate* (chemical symbol $NaNO_3$). It cannot be used for gunpowder because it gathers moisture from the air; but this very fact makes it all the more valuable as a fertilizer.

A third kind of saltpeter, also a fertilizer, is *calcium nitrate* ($CaNO_3$). It often forms on walls of stables.

The word saltpeter means "stone salt" (from Greek *petros* for stone; Latin *sal* for salt).

SALVADOR (*säl-vä-dōr'*), **EL.** Though it is the smallest of the Central American republics, El Salvador has been called "Central America's good example," because of its progressiveness. It is the most densely populated country on the mainland of the Americas. In its small area—about that of Maryland—the people average 126 to the square mile, and about 80 per cent of the land is cultivated. Though it fronts only on the Pacific, its foreign trade exceeds that of some of its sister nations which have both Atlantic and Pacific ports.

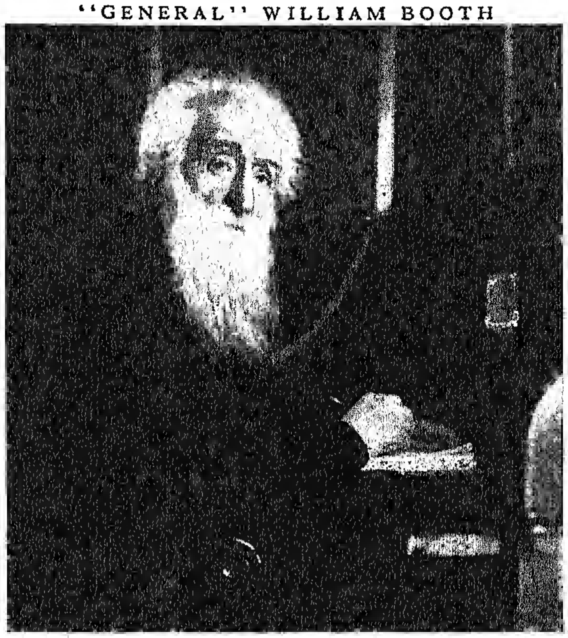
The country is crossed by two high mountain ranges. In the tropical valleys decomposed lava forms a fertile soil. Coffee, which forms from 80 to 90 per cent of the exports, grows on the mountain slopes.

Other exports are sugar, indigo, henequen, and rice. Corn, beans, and rice are the chief food crops; cotton and tobacco also are grown, and cattle are raised. El Salvador suffers from being a "one-crop" country, and the people are being encouraged to try new crops. Gold and silver are mined to some extent.

The Balsam Coast, a small strip on the Pacific, is the sole source of the misnamed Peruvian balsam. This valuable product is the juice of a wild tree related to the acacia. It is exported for use in making perfumery and medicinal compounds.

Salvador has the most curious, the most dangerous, and the most beautiful volcanoes in America. It is a land where the earth trembles frequently, where lakes rise and fall, and where peaceful rivers suddenly become rushing torrents. There is no more wonderful volcano in the world than Izalco, the "Lighthouse," so called because its red glow makes it visible to sailors by night. This cone began to rise out of the plain over a century ago and is now more than a mile high, having built itself up by its own ashes. The majestic San Salvador, overlooking the capital city of the same name, had been dormant since the occupation of the Spaniards and was thought extinct. Suddenly, in 1919, this volcano belched forth from fissures in its sides enough lava to fill two Panama canals. The eruption, with the accompanying earthquake, destroyed nine-tenths of the city. Twice before within a century earthquakes destroyed San Salvador.

"GENERAL" WILLIAM BOOTH



Not until retired by death, at the age of 83, did the old warrior relinquish command of the Salvation Army.

The country has an excellent system of roads and was one of the first to complete its share of the Inter-American Highway. It has well-paved and sanitary cities, and it has efficiently operated telegraph, telephone, mail, and radio services. The International Railways, which connects with Guatemala's interoceanic railway system, links the capital with the chief port, La Unión (Cutuco), on the Gulf of Fonseca, and with the other chief cities—Santa Ana, Acajutla, and Ahuachapán. There is also air service from San Salvador to the United States and to the capitals of other Latin American states.

El Salvador was named by its Spanish conqueror, Pedro de Alvarado, after the "Holy Savior" (San Salvador). Its people are largely of mixed Spanish and Indian blood, and speak Spanish. With their neighbors they revolted from Spain in 1821, and had a turbulent history up to the time of the Central American agreement of 1907, sponsored by the United States. Area, 13,176 square miles. Population, about 1,665,000. (*See also* Central America.)

SALVATION ARMY. On the curbstone of a dreary gin-smelling street in London's East End, in 1865, stood an alert young Methodist revivalist named William Booth. Amid jeers and stones he began to pray for the rough men and women gathered about him. Yet despite this treatment Booth and a few followers (including his heroic wife) went there day after day, to invite the people to meetings which they held —now in a tent pitched on an old deserted burial ground, now in a cheap dance hall or old warehouse —to bring religion to the poor of London's slums, and to do what they could to relieve misery.

Such were the humble beginnings of the great Salvation Army under its "General," William Booth (1829–1912). Its organization and uniform were semi-military, and after 1878, when it first received its name, the growth was phenomenal. Today in more than 95 countries it is found vigorously living up to its aim "to bring spiritual and material benefit to those whom conservative religious bodies do not reach."

The able men and women of this self-sacrificing "army" go quietly about performing the task of "soul-saving." Realizing that privation has driven many persons to desperate courses, the organization has done great things in social relief. Thousands of confirmed drunkards who enter its ranks become, as a condition of membership, total abstainers. Thousands of ex-convicts are given a fresh start in life. Among the many establishments for lending a helping hand to "down-and-outers" are rescue homes, lodging houses, slum settlements, fresh-air camps, day nurseries, free clinics, homes for the helpless aged, labor bureaus, farm colonies, poor men's lawyers, free coal and ice distribution, Christmas dinners, anti-suicide bureaus, etc.

During the first and second world conflicts, the Salvation Army went overseas to serve the Allied soldiers as unobtrusively as it had been working for unfortunates in the slums. Millions of men were directly aided by the refreshments, entertainment, and "mothering" they received in the Salvation Army "huts." Here, often right in the danger zone, soldiers read, wrote, sang, played games, and had their clothes washed and mended.

The Salvation Army is supported by voluntary contributions and by its many publications, among which are *All the World* and the *Young Soldier*. It has about 15,000 posts throughout the world and 1,500 social institutions, directed by more than 25,000 officers and cadets.

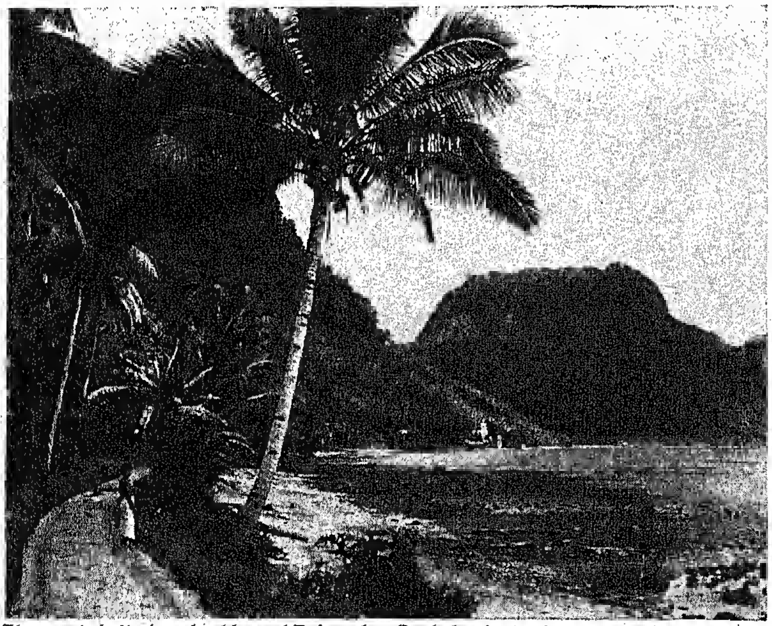
In 1896, Ballington Booth, son of General Booth, withdrew from the Salvation Army, of which he had

been commander in the United States. With his wife, Maude Ballington Booth, he founded a new organization called the Volunteers of America. Its religious and philanthropic work is similar to that of the parent society, but the Volunteers encourage affiliation with churches and religious denominations.

SAMOA (*sä-mō'ȧ*). Far off in the vast South Pacific lies a chain of 14 islands called Samoa—4,200 miles from San Francisco and 2,400 miles from Australia. These beautiful mountains in the sea rise to heights of more than 4,000 feet and were formed ages ago by the eruption of a group of volcanoes. A coral breakwater surrounds them. The total area of the group is about 1,200 miles or about that of Rhode Island.

Wind and rain, weathering the lava through the centuries, deposited a rich alluvial soil over the islands. This good soil, together with the moist, warm climate, makes for abundant vegetation. Giant ferns, vines, palms, and hardwoods grow luxuriantly. Coconut palms and breadfruit trees furnish staple foods. Mangoes, bananas, yams, and taro—a starchy tuber—are plentiful; also oranges, alligator pears, and pineapples. Animal life is scarce, but pigs and chickens have been imported. Most remarkable of the birds is a kind of ground pigeon—a relative of the extinct dodo—with iridescent greenish-black and chestnut plumage. The huge bats called flying foxes abound in the forests.

THE ENTRANCE TO PAGO PAGO'S LANDLOCKED HARBOR



The great sheltering shoulders of Rainmaker Peak dominate the entrance to the harbor at Pago Pago. Inside, lying in the crater of a submerged volcano, hemmed in by mountains and jungle, the waters are very deep and always quiet. The harbor affords protection in all weathers and can accommodate the largest ships.

Native villages dot the level shores. The open houses resemble giant mushrooms set on tall poles, and roofs are thatched with sugar-cane leaves. The Samoan is a pure Polynesian. He is mild-mannered, intelligent, fun-loving, and friendly. With a few primitive tools, he cultivates taro, catches fish, and gathers food in the forest. The principal industry is drying copra (*see* Coconut Palm). The single garment worn by both men and women is the lavalava (or sarong), but Western clothes are gradually taking its place.

Valued chiefly as convenient places for coaling stations on the South Sea trade routes, the islands were for many years the object of rivalry between the United States, Great Britain, and Germany. Finally, in 1889, all disputes were settled with the partitioning of the islands between Germany and the United States, Great Britain receiving compensation elsewhere. The United States obtained the seven eastern islands, with an area of 76 square miles. Germany received the rest. Early in the first World War, New Zealand forces occupied the German group. In 1919 these were mandated to New Zealand by the League of Nations, and are now known as Western Samoa.

Most important of the American group is Tutuila. Here, at Pago Pago, the United States has a naval and coaling station and an air field. Occupying the crater of an extinct volcano, Pago Pago's harbor is one of the finest in the South Seas.

On Upolu, chief island of Western Samoa, is the port of Apia. This little town of 2,000 persons has a radio station, official buildings, and bungalows strung along the shore. In the hills near by is Vailima, Robert Stevenson's home (*see* Stevenson, Robert Louis).

These islands were first sighted in 1722 by the Dutch. Louis de Bougainville explored them in 1768 and named them the Navigators Islands. In 1839 Charles Wilkes, leader of an American expedition to the South Seas, renamed them Samoa.

American Samoa is governed through the native chiefs by the ranking naval officer stationed at Pago Pago. In 1930 a United States commission recommended that the people be granted a bill of rights and citizenship, but final action was never taken. English is taught in Samoa's 37 schools, most of which do not go beyond the sixth grade. All medical care is given free by medical officers of the Navy.

Western Samoa is governed by an administrator and a legislative council of New Zealand and native officials. Schools are conducted by missionaries and by the government.

The total population of the islands is about 70,000, including some 700 whites; American Samoa, 13,273 (1941 census).

SAN ANTONIO, TEX. In the heart of southern Texas, midway between the Rio Grande and the Gulf Coast, the Spaniards in 1718 founded a fort and mission which they called San Antonio de Bexar. It was beautifully located on a plateau from 650 to 700 feet above sea level, rimmed by misty blue ridges. Near by, a number of clear springs bubbled up, forming a small river which was also named for Saint Anthony. On this spot today stands modern San Antonio, the third largest city in the state.

A Rich Historic Background

The river is now spanned by many bridges and the city has spread out over the surrounding hills; yet it remains a shrine of early Texas history. It was the capital of the Texas province during practically the whole of the Spanish and Mexican occupation, but was dominated always by a spirit of independence. When the Mexicans were struggling for freedom from Spain from 1810 to 1821, the city saw many fierce conflicts. And 15 years later, when the Texans won their freedom from Mexico, eight battles were fought in or near San Antonio. The most famous of these was the siege of the Alamo mission-fortress, in which Davy Crockett and 178 other heroic Texans were killed on March 6, 1836 (*see* Texas).

San Antonio retains many traces of Spanish and Mexican influence. Small plazas, vivid with bloom, are scattered through the city. There are the one-story adobe houses of the Mexican quarter, and minstrels singing and playing guitars for coins. There are the yearly week-long fiesta commemorating the Texans' victory at San Jacinto, innumerable spontaneous fiestas, and the ever-present tamale vendors. La Villita (Little Village) is an entire city block reclaimed from the slums and restored to its 18th-century appearance. The long, low Spanish Governors' Palace was purchased by the city in 1929 and faithfully restored to its former grandeur. The architecture of many of the public buildings and business houses is Spanish. The early history of the locality is also reflected in the old missions: San José, San Francisco de la Espada, San Juan Capistrano, and Concepcion. The city block where the Alamo stands is a state park.

Oldest of the many army posts located here is Fort Sam Houston. The great airfields surrounding the city include Kelly, Brooks, and Randolph. So many army fliers have been trained in the vicinity that San Antonio is called the "West Point of the Air."

An Attractive and Prosperous City

Brackenridge Park—320 acres within the city—is almost virgin woodland. Here are the Pioneer Memorial Building, dedicated to the Old Trail Drivers Association, Texas Pioneers, and Texas Rangers, and the Witte Memorial Museum. Here also are the San Antonio Zoölogical Garden, the Sunken Garden, the Civic Outdoor Theater, the Reptile Garden, and many other educational and recreational features. San Pedro Park, a picturesque live-oak grove, was the first public park of the city, being a royal grant from the king of Spain in 1731. In it rises San Pedro Creek, which flows through the western part of the city and unites with the San Antonio River.

Since the coming of the railroad in 1877, San Antonio's growth has been rapid. Nearly 200 miles from any rival business center, the city is an important distributing point for southwest Texas and northern Mexico. It is a leading live-stock, cotton, wool, mohair, and truck market. In manufacturing too it ranks high, having iron and steel works, flour mills, petroleum and cottonseed-oil refineries, cement works, garment factories, packing houses, railroad shops, and leather goods factories. It is also the center of the pecan shelling industry.

San Antonio so delights visitors that it has become an outstanding winter resort. Its people are dignified yet friendly, energetic yet serene. This was the home of O. Henry. When poet Sidney Lanier visited the city in 1872 he wrote, "If peculiarities were quills San Antonio de Bexar would be a rare porcupine." Now, as then, the city is one of many contrasts, fine surprises, and definite charm. Of its population of 253,854 (1940 census), about 36 per cent are of Mexican blood; 9 per cent are Negroes.

SAND. Wind and rain and frost disintegrate solid rocks, decomposing the less stable minerals and leaving the more resistant ones in larger fragments. These fragments, rolling against each other through the ages in stream beds or along shores of seas or lakes, lose their rough edges and become gravel and sand. The last name applies to the rounded particles of resistant mineral matter, mostly quartz, between about one-tenth and one one-hundredth of an inch in diameter.

Sand has a number of curious properties and important uses. Dry sand is blown about extensively by wind and deposited as "dunes." Dunes, which are mounds, hills, or ridges of wind-deposited sand, are common along sandy shores, and in other places where dry sand abounds. Dunes abound in many deserts, such as the Sahara, and in semi-arid regions, such as western Nebraska. Unless anchored by vegetation, dunes are likely to migrate by the slow shifting of the sand from the windward to the leeward side of the dune. Migrating dunes have invaded many a fertile farm and fruitful orchard. In New Jersey, windblown sand has overwhelmed orchards near the coast so that only the topmost twigs protrude. Similar devastation has been wrought or threatened by advancing sand at various places on the Atlantic and Pacific coasts.

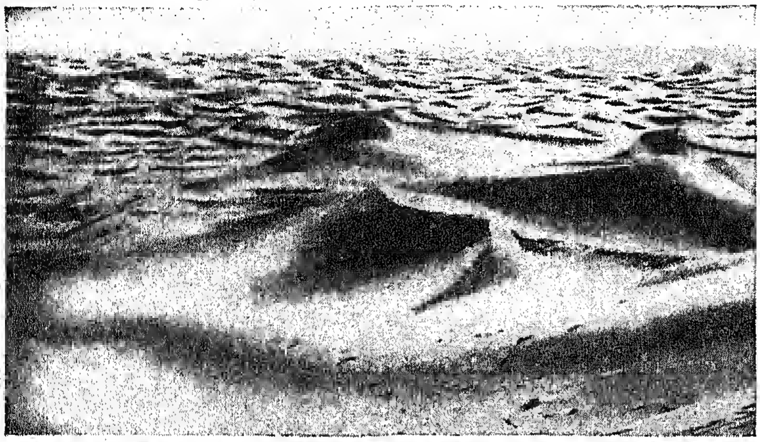
Near Manistee, Mich., a bonfire built by picnickers on a stationary dune burned the grass which held it in place. The hill shortly began to advance, and before the sand was pinned down by replanting, its movement seriously threatened the city waterworks and other property. In New Zealand, sheep pastured on grass-covered dunes have done similar damage. The great estate of Culbin, on the northern coast of Scotland, celebrated for its fertility, was engulfed in sand toward

the end of the 17th century, and ever since, the entire region, about 3,000 acres of ground, has been a shifting waste. Large cities lie buried under the sand hills of the desert of Gobi, in Central Asia.

How the Wandering Hills are Kept at Home

Fortunately, wandering dunes may be fixed: (1) by the erection of artificial barriers, fences, or hurdles; and (2) by the planting of grass and other vegetation which will grow in sand. Both means were employed in the redemption of the "Landes" of Gascony (France) on the Bay of Biscay. A hundred years ago this region was a vast sandy wilderness marching inland at the rate of about 16 feet a year; today it is a great pine forest, a source of lumber and turpentine, sheltering a rich inland farming region. Only vegetation will hold the soil permanently, and few plants are tenacious and hardy enough for the pioneer work. The dunes near Provincetown on Cape Cod, Mass., are controlled by the systematic planting of beach grass followed by shrubs and trees. The Golden Gate Park in San Francisco is protected from wind-blown sand by judicious planting.

A SANDY SEA OF ALGERIA



Riding along the southern frontiers of Algeria during a high wind, one may enjoy the impressive sight of hills brought low and valleys raised up into hills under one's very eyes.

The dune region of Lake Michigan, including the entire Indiana shore and parts of the adjacent shores of Michigan, is, because of its situation, exceptionally favored with moisture, and therefore has a remarkably varied and beautiful plant life. Nature lovers have succeeded in getting a tract in these dunes set aside as a state park. Though this is not an arid region, the sand brought to the head of the lake by shore-currents is dry for days at a time; it is then that the wind plays with it. Wet sand is never blown about by the ordinary wind.

Sandy shores are constantly being made and unmade by wind and water together. A map of 1715 shows the upper part of Cape Cod as an island. In 1848, what is now James Island off the coast of South Carolina was a peninsula. The foot of an old lighthouse at Cape Henry, Va., was swept by the tides when it was built a hundred years ago; now it stands high and dry on a sandy hill, and it has been necessary to build another lighthouse at the water's edge.

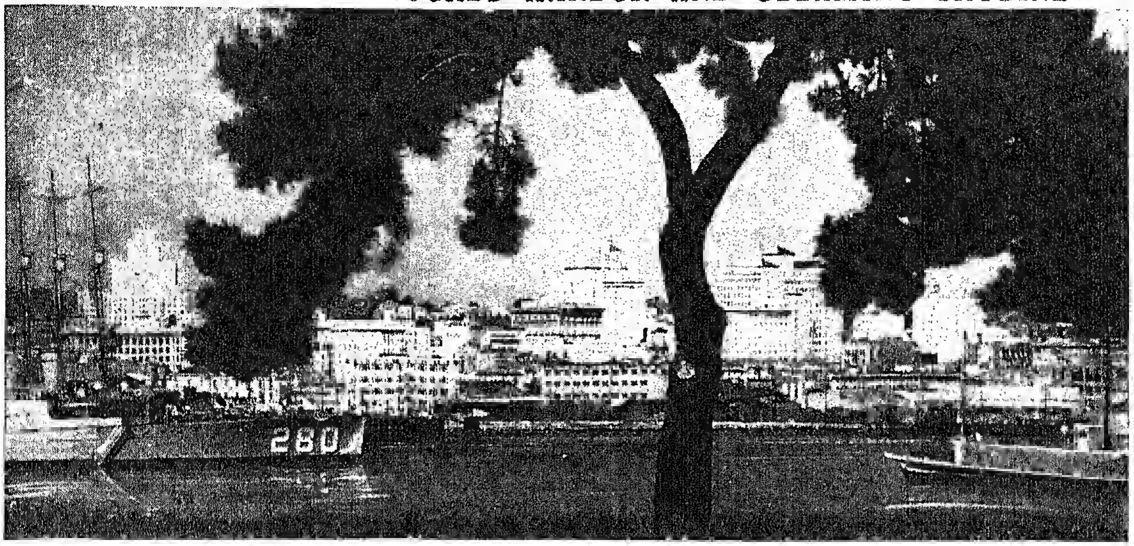
Sand mixed with water is in many ways quite a different thing from dry sand, particularly with reference to the bearing of weight. If you have ever walked on a sandy shore, you know how your feet sink at every step into the dry sand. On the other hand, the wet beach from which the tide has ebbed is somewhat yielding, yet almost as firm as a cork or asphalt pavement. On the Florida coast at Daytona Beach, the beach is used for automobile racing. Firmness is characteristic of sand wet with just enough water to fill the spaces between the grains.

Quicksands, which have been known to swallow up living men, like the Master of Ravenswood in Scott's 'Bride of Lammermoor', might almost be thought another substance from ordinary sand. Indeed, the name itself ("quick" is here used in the old sense of "living," as in the phrases "the quick and the dead," "cut to the quick," etc.) hints as much. In fact, there is no mysterious difference between sand and quicksand. The foot sinks through the upper layer of dry sand, but stops when it reaches sand which is held comparatively close-packed and stable by the weight of the sand above; otherwise one would continue to sink. Quicksand is merely sand in which the grains below the surface slide readily on each other as the dry sand grains do on the top of the dry beach. Perhaps a hidden spring wells up under the sand with just enough force to keep the grains loose. Perhaps decaying weeds and other organisms buried under the sand are generating gas which has the same effect. Perhaps there is just enough slimy mud and air mixed with the sand to make a medium in which the sand grains roll and any heavy object is held fast by air pressure.

Mysterious Music of the Sands

So-called "musical sands" and "singing beaches" occur in various parts of the world. Sand on the beach near Manchester, Mass., gives a crackling sound; the "singing sands" of Mount Sinai are said to give a sound like an Aeolian harp, increasing to thunder notes, and the Djebel Nakus or Bell Mountain in Arabia Petraea gives forth a sound like a chime of bells, terminating in a roar, which the Bedouins attribute to a ruined Christian monastery. Elsewhere the sound is likened to that of a humming telegraph wire. The cause has been much discussed, but agreement has not been reached. In some cases the singing depends on the amount of moisture in the sand. It will not sing if dry or if very wet, but will if barely moist. This is true of the sand at the head of Lake Michigan.

SAN DIEGO'S LAND-LOCKED HARBOR AND GLEAMING SKYLINE



As we look across the bay of San Diego from Coronado, we see shining waters crowded with shipping, and, in the background, many towering white buildings marking the business center of the city.

Quartz is the mineral of which common sand is composed, but there are sands which contain other minerals in abundance. The Columbia River sands contain a large number of minerals, including magnetite, gold, zircon, garnet, pyrites, and some other rarer ones. The so-called "white" sands of New Mexico are nearly pure gypsum. Arkose sand contains feldspar, hornblende, mica, etc.

Not content with breaking down the rocks into sand, Nature develops sandstone from sand. Under heavy pressure, the grains are crowded close together, and then are cemented by mineral matter such as calcium carbonate, iron oxide, and silica, deposited from solutions from the waters percolating through the sand. On cementation the sand becomes sandstone. Sandstones are of various colors and degrees of hardness. Certain sandstones are much used for building purposes. Other varieties are used for grindstones and oilstones.

The uses of sand are legion. Twenty inches of dry sand will stop an ordinary bullet, and during the World War sandbags were an important means of defence. The sandblast is a device by which sand is driven through the nozzle of a tube by a blast of air or steam; its uses range from the cleaning of building-fronts and rusted iron to the engraving of glass and the cutting of inscriptions on stone. Sand is an important ingredient of mortar, cement, and asphalt pavements, and is used in pottery and for molds in iron foundries. Bricks made of sand are harder and will bear a greater weight than bricks of clay.

Sand with a high percentage of silica is demanded for glass-making, the grade of glass varying with the purity of the sand. The size and evenness of the grains is also important. Glass sand is widely distributed over the United States, but sand which can be used in the manufacture of high-grade glass is found in but few places. In the manufacture of glass the quartz is fused with certain other substances, such as sodium. Green bottle glass is made from impure sand, the color being due to iron. (*See* Glass.)

SANDALWOOD. The fragrant and fine-grained sandalwood, so prized by the Chinese and East Indians for making elaborately carved boxes and the fragile carved sticks of fans, comes from certain tropical islands of the Pacific Ocean and East Indies. It was the discovery, in 1804, that these myrtle-like evergreens were native to the Fiji Islands that led to the first European settlement there.

Ground into powder and moistened to a paste, the Chinese make of sandalwood long slender spirals that burn like incense in their temples and on the altars of their household shrines. Hindus make of the paste, colored bright vermilion, the caste-marks on the forehead which distinguish the Brahmans from other castes; and when princes die in India their funeral pyres on the steps of the burning-ghat are built of sweet-scented sandalwood.

There are several species of sandalwood trees—white, yellow, red, etc.—all belonging to the genus *Santalum*. Successful attempts have been made in India to cultivate sandalwood plantations. The trees never exceed 30 feet in height and a foot in diameter. The fragrance of the wood is due to its essential oil, valuable also in medicines, the roots being even richer in it than the branches and trunk.

SAN DIEGO (*săn dē-ā'gō*), CALIF. Three unique gifts the good fairies gave to San Diego—an incomparable view from Point Loma, a climate which is like "Alaska in summer, Arabia in winter," and a land-locked harbor, the southernmost on the Pacific coast of the United States, wide enough and deep enough to

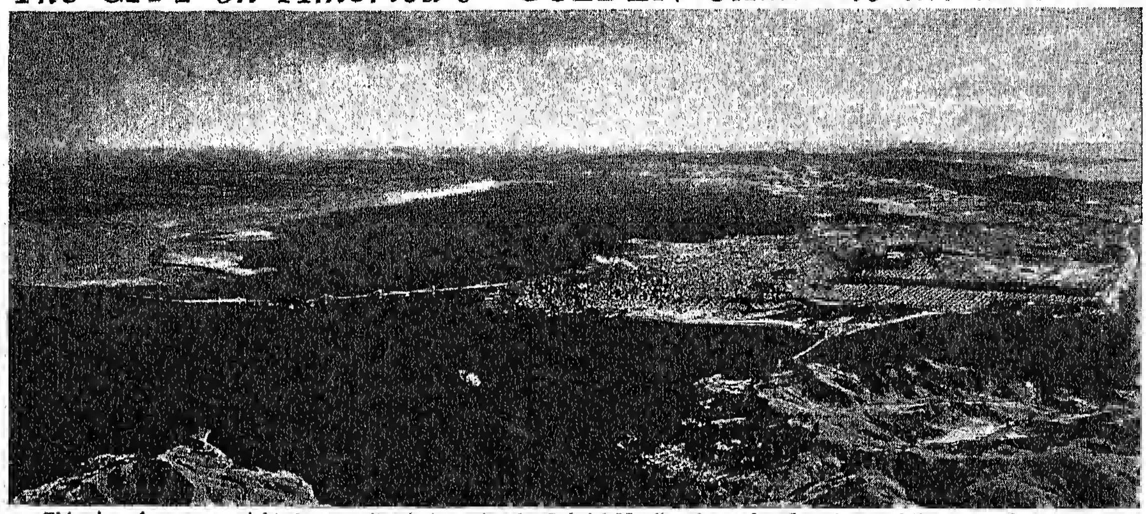
shelter a fleet of warships in its 21 square miles. This great bay is the first port of call for vessels traveling north from the Panama Canal, and is the base for cruisers, destroyers, and submarines of the Eleventh United States Naval District. It is protected from the ocean on the west by a long narrow sand spit which swings up from the south, to end in two swellings of land—one the site of the city of Coronado, the other known as North Island. From the mainland at the north, Point Loma projects south and west, outside North Island. Travelers agree that the view from Point Loma is one of the finest in the world. On Point Loma is Fort Rosecrans, a United States Army coast-defense post. The United States Marine Corps base is at the north end of the bay. The Naval Air Station and Rockwell Field, a training school of the Army Air Corps, are on North Island.

San Diego has been a pioneer in aviation, and the scene of many famous "firsts." It was the terminus of the first non-stop cross-continent flight, made by Macready and Kelly in 1923. The first air photographs and the first night flying were among the other "firsts." Charles Lindbergh's *Spirit of St. Louis* was manufactured here.

Fishing and fish canning are the principal industries. Airplanes and airplane motors, parachutes, boats, and various foodstuffs are also produced. On a height overlooking the city is beautiful Balboa Park. Here were held the Panama-California Exposition of 1915–16 and the California-Pacific International Exposition of 1935. There are many winter and summer resorts near San Diego. At La Jolla is the Scripps Institution of Oceanography. The Universal Brotherhood and Theosophical Society has its international headquarters on Point Loma.

San Diego is the site of the first permanent white settlement on the Pacific coast in what is now the United States. Here in 1769 Father Junipero Serra founded the first of the missions along *El Camino Real*—"the King's Highway." The Old Town still stands, with many historic structures. The house known as "Ramona's Marriage Place" is said to be one of the scenes of Helen Hunt Jackson's Indian romance 'Ramona'. Population (1940 census), 203,341.

The CITY *on America's* "GOLDEN GATE" *to the* PACIFIC



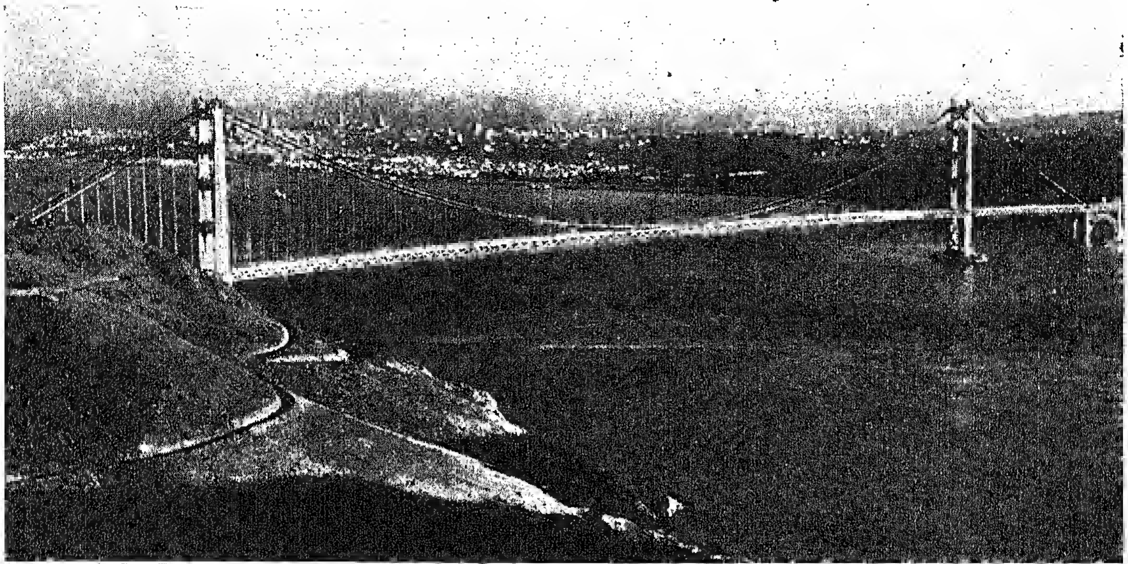
This view, from a copyrighted composite airplane view by Gabriel Moulin, shows San Francisco and the bay region as seen from the north. The Golden Gate Bridge is inside the Pacific Ocean at the right, and the Bay Bridge runs east to the mainland.

SAN FRANCISCO, CALIF. The great twin valleys of the Sacramento and the San Joaquin rivers meet midway in the state of California to make a united thrust westward at the Coast Range, and lo! the wall opens on the greatest land-locked harbor in the world —San Francisco Bay. Enthroned on the southern horn of the Golden Gate, guarding this harbor sits San Francisco. Few cities so combine beauty of situation with strategic advantage on the grand scale.

Historically the most important Pacific port of the United States, and still among its giants in its volume of commerce, San Francisco trades with almost the whole world, but chiefly with the near South and with the Far East—with South and Central America, with China and Japan, the Philippines, the British and Dutch East Indies, and Australia and New Zealand. Along the waterfront any day may be seen the living souvenirs of this traffic with far outlands—black Gilbert Islanders and brown Kanakas, turbaned Lascars, heavy-featured Russians, Alaska Indians, and swarthy blue-sashed Italians—making, with the unassimilated Chinese and Japanese, as strange an assortment as any melting pot can be asked to fuse.

From San Francisco's busy wharves thousands of ships sail annually with cargoes of oil, grains, flour, cotton, tobacco, and canned foods, bringing back silk, coffee, sugar, copra, paper, tea, tin, and bagging. Much of this flood of imports flows into San Francisco

THE GOLDEN GATE STRAIT AND ITS MAJESTIC BRIDGE



Before us is San Francisco's magnificent Golden Gate Strait and its record-breaking bridge. **We are viewing the scene from the northwest, and we see how the Strait connects San Francisco Bay, beyond the distant city, with the Pacific Ocean, just out of sight at the right. The dark, wooded area beyond the far end of the bridge is the Presidio, a military reservation; then, to the left, on several hills, is a thickly settled part of San Francisco. The business district is just beyond these hills. At the extreme left is Telegraph Hill, where men with telescopes once kept watch for every ship which entered the Strait.**

factories, so that spice grinding, coffee roasting, candy making, bag making, and the manufacture of tinware are large industries.

The Great Valley east of San Francisco pours grains, fruits, vegetables, wood, minerals, and cattle through the city and is as much a factor in its prosperity as is the broad harbor. Slaughtering and meat packing, food canning, shipbuilding, printing, and the manufacture of clothing, furniture, and iron and steel products are all important. California has no coal, but hydroelectric plants and crude oil furnish plenty of cheap clean power to run its industries.

The Effects of the Earthquake

The great earthquake of 1906 and the fire which raged over a third of the city in its wake, killed about 700 people, left 100,000 to 200,000 homeless, and caused a property loss of $200,000,000. This disaster destroyed many of San Francisco's links with the past, but the old sea-misty buildings of brick and redwood have been replaced by modern structures of concrete and terra cotta. Old Chinatown is gone; the new one, though strange and exotic enough, is vastly more sanitary, and frowns on "tong" wars and "highbinders." It uses telephones enough to need a large exchange with Chinese operators. The Chinese are very much a part of the city's life, with their lacquered bazaars of Grant Avenue only a few minutes' walk from the fashionable shops of Union Square.

A fitting symbol of the new city is the magnificent civic center, with public buildings grouped about an imposing plaza. The dome-crowned City Hall is here, and a dignified group including the public library, the State Building, a great auditorium, and the War Memorial with a hall and opera house.

Among San Francisco's proud memories are its expositions. The Panama-Pacific International Exposition of 1915 was held to celebrate the opening of the Panama Canal. The city's island airport of 400 acres, built in San Francisco Bay, was the site of the Golden Gate International Exposition of 1939 and 1940.

Where Streets Climb Straight Up Steep Hills

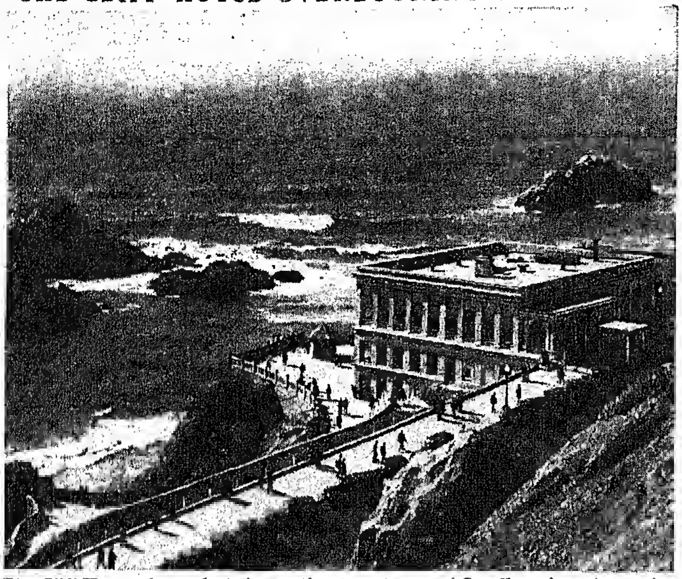
The axis of San Francisco is Market Street, a busy thoroughfare with four lines of car tracks, which crosses the city from northeast to southwest. Montgomery Street has been called "the Wall Street of the West," for it is the heart of the financial district, and San Francisco is an influential financial center. The streets run at right angles, regardless of the hills on which the city is built, and in many places are so steep that one almost climbs, rather than walks, up them. The hills—there are Nob and Telegraph and Twin Peaks and Russian Hill and many others—rise so abruptly that a cottage may look down on a skyscraper.

For miles one may drive through Golden Gate Park, spreading over more than 1,000 acres, and running from the center of the city three miles westward to the ocean. Here one will ride past Steinhart Aquarium and Kezar Stadium, along the sea, and round clusters of scarlet and magenta rhododendrons. Sightseers will also view the seals of Seal Rocks; the stout ship *Gjöa*, in which Roald Amundsen's brave band of explorers first traversed the Northwest Passage; the United States mint, second in size only to that of Philadelphia; the old presidio reservation on the shores of the Golden Gate, now the United States Army headquarters for the Department of California; and the Palace of the Legion of Honor, presented as a war

memorial by Mr. and Mrs. A. B. Spreckels. The Palace is built on the cliffs overlooking the Golden Gate, and it has long galleries for exhibiting paintings, sculptures, tapestries, and etchings.

The sea winds from the warmer ocean are cooled by a cold ocean current off San Francisco and often condense into thin gray fogs; these same winds give the city its cool even climate.

THE CLIFF HOUSE OVERLOOKING THE PACIFIC



The Cliff House, located at the northwest extreme of San Francisco, has at its feet the noted Seal Rocks, where the sea-lions play.

A City That Knows How to Play

San Francisco is the city that Robert Louis Stevenson hated to leave; a city of old restaurants with weird names and delectable cookery; a city where people know how to play. One sees young folks in hiking clothes boarding the ferry across Golden Gate ready to climb Mount Tamalpais. Whole families spend week-ends on house-boats in the bay or at lodges in the mountain canyons. Golfers tramp over courses stretching along the windy hills. Latin and Anglo-Saxon bloods have mingled through generations to produce a people who work hard and play hard and know beauty in nature and the arts. The city has its own symphony orchestra. Its theaters have attracted large audiences since the 50's. Among the writers either born in San Francisco or else closely associated with it have been Bret Harte, Jack London, Mark Twain, Ambrose Bierce, Frank Norris, Will Irwin, Charles W. Stoddard, Charles and Kathleen Norris, and Gertrude Atherton. The city produced the sculptor Robert Aitken, numerous artists, David Warfield and David Belasco of theatrical fame.

The University of San Francisco, the San Francisco College for Women, the San Francisco State College, the school of medicine of Stanford University, and the schools of fine arts, law, medicine, dentistry, and pharmacy of the University of California are in the city. Near by are Stanford University at Palo Alto, the University of California at Berkeley, and Mills College and St. Mary's College at Oakland.

San Francisco's Life Story

Such keen-eyed and eager navigators as Juan Rodriguez Cabrillo, and Sebastian Vizcaino failed to discover San Francisco Bay as they explored the coast, and Sir Francis Drake sailed straight past the Golden Gate in 1579 to plant the English flag on Drake's Bay to the north. Then, in 1769, Don Gaspar de Portolá, Spanish governor of Lower California, stumbled upon the bay by chance while searching for Monterey Bay. He named his find after St. Francis, the patron saint of the expedition. Juan Bautista de Anza escorted colonists and mission fathers there in 1776 and built a presidio and the Mission Dolores, which is today a relic. The little Spanish settlement was called Yerba Buena ("good grass") before its name was changed in 1847 to San Francisco. (*See* Southwest, American.) A favorite romance of those days is that of the lovely Concepcion Arguello, daughter of the presidio commander. From his Russian trading posts in Alaska in 1806 came Baron Nicolai Rezanof to court Concepcion. There were difficulties. Concepcion was a Roman Catholic; the baron belonged to the Russian Church. He set out on the long journey to Rome to get the pope's permission to the marriage. But on the way across Siberia he died. The girl, refusing all other lovers, entered a convent.

Mexico ruled the village after 1821 until it became part of the United States in 1848. Then gold was discovered thereabouts, and fortune hunters rushed to San Francisco from all over the world (*see* California). The Union Pacific Railroad in 1869 was the first transcontinental line that came to the city.

City and county government are united in San Francisco under a board of supervisors, a mayor, and other officials elected by the people. The city has had several charters since its first one, dated 1850.

More than 30 years' planning and building and an expenditure of about $100,000,000 were required to bring a water supply for San Francisco from the Hetch Hetchy Valley in the high Sierras, more than 160 miles away. The O'Shaughnessy Dam, pressure tunnels, and a pipe-line bridge across San Francisco Bay are parts of the system. In 1936, an 8¼-mile bridge, the longest in the world, was opened to Berkeley and Oakland. In 1937 the Golden Gate Bridge, with the world's longest clear span, was finished (*see* Bridge). The Golden Gate Exposition of 1939-40 celebrated these feats. Population (1940 census), 634,536.

SANTIAGO (*sän-tē-ä'gō*), CHILE. One of the most beautifully situated of the world's cities is this capital of Chile and largest city on the western slope of South America, situated in a charming plain through which

flows the river Mapocho. Mountains surround it, and in the center rises the picturesque rocky hill of Santa Lucia, which was once a citadel but now is the city's pleasure ground.

Chief among the broad straight streets is the Avenida de las Delicias, 325 feet wide, with four rows of poplar trees. In the center is a promenade dotted with lines of statues, many of which are spoils of the Peruvian war, while driveways 100 feet wide lie on either side. Along this avenue are many magnificent residences built in the old Spanish style around a "patio" (court) containing fountains and flowers. There are many beautiful churches and public buildings, for Santiago is the social and educational capital of Chile, as well as the seat of government. In addition to the University of Chile there are several professional and normal schools. The luxuriant parks in and near the city are maintained by irrigation, for the rainfall is scanty. The city has suffered severely from earthquakes on numerous occasions.

A transandine railroad connects Santiago with Valparaiso, the leading seaport of Chile (about 116 miles northwest by railway), and with Buenos Aires, the capital of Argentina, on the east coast of the continent. Population, about 830,000.

SANTO DOMINGO. After nearly a century's attempt to maintain itself as an independent nation, the Republic of Santo Domingo (or Dominican Republic), located on the eastern two-thirds of the island of Hispaniola, found itself in a nightmare of rebellions, assassinations, and boundary wars with the rival republic of Haiti. It had separated from Haiti in 1844. Spain took over Santo Domingo in 1861, but recognized its independence four years later. The Dominican government failed to pay interest on bonds held in Europe, and at last, in 1905, the situation was so serious that some sort of foreign intervention seemed inevitable.

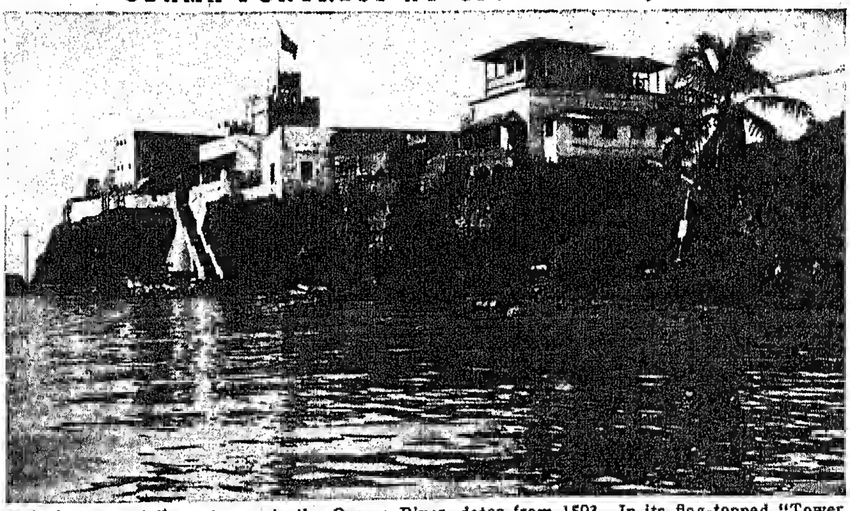
With Europe threatening to collect its debts by taking over Santo Domingo's administration, the desperate republic turned to the United States for aid. A treaty was framed under which the United States took control of its financial affairs, and soon Santo Domingo not only was paying $1,200,000 a year on its debt, but found itself with a net income for government use greater than it ever had before.

But Santo Domingo politicians had formed the habit of making trouble, and the United States was forced in 1916 to intervene and establish a military government. In 1924 all American officials except a commissioner of customs were withdrawn. Supervision of the customs was withdrawn in 1941. By the constitution of 1924 the republic has a president and a legislature with two chambers, elected by popular vote. The governors of the 12 provinces are appointed.

Four-fifths of the area of this tropical island is a mass of snow-capped mountain ranges, precipitous ravines, and broad rivers flowing through twilight jungles. The north coast, watered by the trade winds, has vegetation of tropical luxuriance, and on the south coast are some of the best sugar lands in the West Indies. The plains between the mountains derive moisture from the trade winds in the east and are prodigally fertile; but farther west, in the little-settled drier interior, they are chiefly pastureland for cattle, sheep, goats, horses, and mules, and in spots are as bald as a desert. Though the Americans built many miles of good roads, most of the country must still be reached on horseback or on donkeys over narrow trails. The republic has several good natural harbors, but its rivers are navigable only for comparatively short distances.

The native has an easy life in his palm-thatched hut. In contrast to Haiti, Puerto Rico, Barbados, and other sections of the West Indies, the Dominican Republic is not thickly populated. Thus, natives can choose the richest plots of land and with little work raise such money crops as sugar cane, cacao beans, tobacco, corn, and coffee, and such food crops as bananas, squash, and plantain. Sugar cane is the largest crop, and sugar manufacture is the chief industry. Cigars and cigarettes, straw hats, matches, soap, and beer also are manufactured. Copper, gold, iron, petroleum, coal, silver, and platinum exist, but, like the dense pine forests, have been little exploited

OZAMA FORTRESS AT CIUDAD TRUJILLO



This fortress, at the entrance to the Ozama River, dates from 1503. In its flag-topped "Tower of the Homage" Diego Columbus and his court lived in 1509, and here Oviedo wrote his famous 'History of the West Indies', first published in 1526.

because of political unrest and poor roads. Railroads total only some 150 miles. Now, however, the republic is building automobile roads, and airplane lines join it to South America and the United States. Sugar and other money crops, as well as lignum vitae, dyewood, and mahogany, are exported, chiefly to Canada, France, the United States, and England.

Unlike its neighbor, the Republic of Haiti, the Dominican Republic has a relatively small Negro population. About four-fifths of the people are whites or *mestizos* (of mixed parentage). Spanish is the prevailing language.

The capital, Ciudad Trujillo, is the oldest city settled by Europeans in the New World. Bartholomew Columbus, brother of Christopher, founded it in 1496 as Santo Domingo, and traces of 16th-century grandeur linger in the massive ruins of its great stone churches and palaces. The name was changed in 1936 in honor of Gen. Rafael Trujillo, then president of the republic. Trujillo pushed the country's development, but his régime was censured for its dictatorial ruthlessness. Area of the Dominican Republic, more than 19,300 square miles. Population of the republic, about 1,500,000; of Ciudad Trujillo, about 70,000.

SARATOGA SPRINGS, N. Y. Sparkling springs of mineral waters and the beauty of its natural setting make Saratoga Springs a famous health and pleasure resort. It lies 30 miles north of Albany in the wooded foothills of the Adirondack Mountains.

So beneficial are its waters that people in Colonial days risked wilderness travel to drink them. In 1912 the principal springs became the nucleus of Saratoga Spa, an institution operated as a part of the state public health service. More than 5,000 persons may be treated daily in the three mineral bathhouses. A hotel, a research laboratory, and other facilities were built by the state in 1935. The spa is open the year round, and the waters are shipped to all parts of the world.

Catering to visitors is the chief industry of the spacious old city. Government is by the commission plan. Skidmore College for women and Yaddo, a retreat for artists and writers, are within the city. The August horse races have been a national social event since 1864. Population (1940 census), 13,705.

About 17 miles east of the city is the sprawling site of the battles of Saratoga, now a national park. Here in September 1777 General Gates entrenched his American army on Bemis Heights, near Stillwater. On September 19 the British, under General Burgoyne, advanced to attack, but were blocked at Freeman's Farm by the fierce assault led by Gen. Benedict Arnold and Col. Daniel Morgan. Burgoyne again attacked on October 7, but Arnold again rallied the Americans and forced Burgoyne to retreat to Saratoga Heights, where he surrendered on October 17. This was the turning point of the Revolutionary War and hence has been ranked among the 15 decisive battles of the world. (*See also* Revolution, American.)

SARDINES. True sardines, or "pilchards" (*Clupea pilchardus*), are small olive-green fish belonging to the herring family. They are found chiefly in the Mediterranean Sea and off the west coast of France. They obtained the name "sardine" because they were first caught in large quantities off the island of Sardinia, in the western Mediterranean. Portugal, Spain, and France furnish most of the true sardines of commerce. The United States and Norway lead in the canning of other kinds of "sardines."

The fish are caught in nets when young. They are first beheaded and cleaned, then washed, dried, and cooked in oil. They are then drained and placed in cans with fresh olive oil. When the lids are soldered on, the cans are plunged for a time in boiling water or in steam before soldering the vent hole.

In the United States, the young of the herring and menhaden (pogy), caught off the New England coast, are packed in vegetable oil and marketed as "American sardines." These form the greater part of the cheaper sardine trade in this country, the imported kind being much more expensive. There is, however, a variety of the true sardine or pilchard found on the Pacific coast and called the California sardine (*Clupea sagax*). These fish, which are slightly larger than the herring, are exceedingly rich in oil. Part of the catch is canned for food, but most of it is used for the extraction of the oil, which is used in the manufacture of soaps and paints.

The European pilchards are also caught when full-grown. They are salted and cured for food, and the oil is extracted for industrial purposes.

SARDIN'IA. Despite Sardinia's central position in the smiling Mediterranean, despite its ancient history stretching back for centuries before Christ, it remains today a forbidding land. True, the people are honest, courteous, and hospitable, but they are poor and unprogressive. Although the island belongs to Italy, the Italians from the peninsula look upon it as a place of exile. Malaria long raged there, killing a higher percentage of people than in any other part of the kingdom. Comparatively few of the peasants know how to read and write.

Yet Sardinia has wealth and great possibilities. Her forests are the largest on Italian soil. Her mines, dating back to ancient times, yield quantities of iron, zinc, and lead, while silver, manganese, antimony, copper, and coal are found in profitable quantities. The tunny, lobster, and sardine fisheries are also thriving industries. But these are mostly in the hands of foreigners. The short dark-haired natives, who resemble the Spaniard more than the Italian, dwell mostly on small farms, raising a little grain and herding their cattle, sheep, and goats among rocky hills where the wild boar, stag, wild sheep, eagle, and vulture still make their homes.

The Sardinians are believed to be descendants of the ancient Mediterranean race, whose stone forts covered the island during the Bronze Age. The first definite history of Sardinia begins with its conquest by the Carthaginians in the 5th century B.C. It later became a Roman province, and was one of the leading sources of the Roman grain supply. The inhabitants remained pagans until the 7th century A.D. In the

Middle Ages the island was the scene of fierce struggles between Saracen invaders and the fleets of Pisa, which came in response to a crusade preached by the pope (1004) to oust them, and for three centuries possessed the island. In the 14th century the king of Aragon won it, and it remained Spanish until the War of the Spanish Succession transferred it to Austria in 1713. In 1720 Austria forced the Duke of Savoy to take it in exchange for Sicily. The island then gave its name to the newly formed "Kingdom of Sardinia," which included the more important territories of Savoy and Piedmont. It was this kingdom which became the nucleus around which Cavour, Garibaldi, and Victor Emmanuel established in 1861 the kingdom of modern Italy (*see* Italy).

Sardinia is 160 miles long and 68 miles wide, with an area of 9,299 square miles. The only stream worthy of mention is the Tirso, 94 miles long, which empties into the Gulf of Oristano on the west coast. The highest point is Mount Gennargentu (6,000 feet) in the center of the island. The Strait of Bonifacio, 7½ miles wide, separates it from the island of Corsica on the north. East of this strait is a group of small islands which includes Caprera, at one time the home of the Italian patriot Giuseppe Garibaldi.

Sardinia is divided into two provinces, named after their respective capitals—Cagliari in the south, and Sassari in the north. There are over 600 miles of railroad, and steamers connect the island with Naples, Genoa, Palermo, Leghorn, Tunis (Africa), and Corsica. Population, more than 1,000,000.

SARGENT, JOHN SINGER (1856–1925). The spirit and training of many lands combined to make John Singer Sargent a famous painter. He was born in Italy of American parents, spoke his first words in German, received his art education in France, found fame in England, and made only brief visits to America. Yet, when asked why he did not become a British subject, since he spent most of his life in England, he replied that he preferred to remain a citizen of the United States.

SARGENT
Painter of the "Inner Face"

Though regarded as a portrait artist, he is chiefly known in America as the man who "painted the prophets." This reputation is based on the famous decorations painted by him in the Boston Public Library. On the walls of its great hallway, which now bears his name, appear in impressive and solemn array the great figures of the Jewish and Christian religions. They form part of a general scheme depicting the "Pageant of Religion." The splendor of the arrangement on the wall space rivals in many ways the work of the great wall painters of the Renaissance. The Hebrew prophets are perhaps the best known of the groups, and reproductions of the figures of "Hosea" and others are familiar sights in all art stores. These mural paintings, begun in 1890, were not completed until 1916. (For illustration *see* Prophets.)

Sargent's portraits were perhaps the most celebrated of their day. His sitters included men and women of great distinction in the literary, artistic, and social life of Europe and America. With masterly technique he combined a marvelous skill in picturing the mind and soul of his subject. Whatever he saw, whether pleasant or unpleasant, was put into the finished portrait. For this reason he was often called a "dangerous" painter for those who had anything to conceal. As was said of Stuart, another great American portraitist, Sargent painted the "inner face." There is a legend that a doctor, puzzled by a certain case, found the secret of his patient's baffling personal nature revealed in a portrait done by Sargent.

Among the notable portraits by Sargent are those of Theodore Roosevelt, Joseph Jefferson the actor, and Ellen Terry the actress, as Lady Macbeth. His best figure pieces include 'Carnation Lily, Lily Rose', in the Tate Gallery, London; 'Carmencita', Luxembourg, Paris; and 'Gitania', Metropolitan Museum, New York City. 'The Fountain' and 'Trout Stream in the Tyrol' are in the Chicago Art Institute.

SARSAPARIL'LA. The next time you enjoy a glass of cooling sarsaparilla "pop," think that to obtain the root from which this pleasing flavor is made an Indian toiled somewhere in the tropical forests of Central America. For sarsaparilla extract is prepared from the long fibrous roots of a twining shrub or vine,—a near relative to the northern smilax found in old-fashioned gardens,—which grows in swampy forests from the northern and western boundaries of Mexico south to Peru. The brownish roots, about as thick as a goose quill, extend horizontally on all sides of the plant for about nine feet. The earth has to be scraped away and other roots disentangled very carefully to avoid injuring the sarsaparilla root. When dried it is ready for market. To obtain the extract the dried roots are boiled.

Sarsaparilla roots were taken from the New World to Europe as early as the 16th century. For many years the extract was used as medicine in stomachic disorders, and still retains that reputation among many people, although modern medical science maintains it has no medicinal value. There are several varieties of sarsaparilla in commerce, named from the countries from which it is exported.

The two principal species are *Smilax officinalis* and *Smilax medica*, growing respectively in Jamaica and Mexico. The "wild sarsaparilla" or "false sarsaparilla" of the eastern United States and Canada is a nearly stemless woodland herb, *Aralia nudicaulis*.

In SASKATCHEWAN'S VAST and FERTILE FIELDS

Extent.—North to south, 760 miles; east to west, 275 to 390 miles; area, 251,700 square miles. Population, (1936 census), 930,893.

Natural Features.—Bounded north and south by the 60th and 49th parallels, and on the west by 110th meridian. Rolling country, rising in the west and broken by low hills; southern prairies separated from the northern forests by a park region interspersed with woodland. *Athabaska, Reindeer, Wollaston, Quill, Last Mountain*, and numerous smaller lakes. Principal rivers: Qu'Appelle, Saskatchewan, and Churchill.

Products.—Wheat, oats, barley, rye, flax, hay, potatoes; cattle and dairy products, horses, sheep and wool, hogs; furs; coal, cement, and clay products; lumber and timber; flour, packing-house products, foundry and machine-shop products.

Cities.—Regina (capital, 53,354), Saskatoon (41,734), Moose Jaw (19,805), Prince Albert (11,049), Weyburn (5,338), Swift Current (5,074), Yorkton (4,931), North Battleford (4,719).

SASKATCH'EWAN, CANADA. One may travel mile after mile through parts of the province of Saskatchewan, in western Canada, and see nothing but the endless fields of waving grain which make it the greatest wheat-growing district of the Dominion. But Saskatchewan covers more than 251,000 square miles—nearly the size of Texas—and naturally that large area, extending 760 miles north and south, is not all wheat land. Of the 94,000,000 acres reckoned to be fit for agriculture, only about 55,000,000 have been occupied by farmers. In the southwestern section, in many seasons grain cannot be grown without irrigation; but stock ranching is exceedingly profitable, and here are many large ranches of from 1,000 to 20,000 acres. Great undeveloped low-grade coal deposits underlie much of the southern portion. In the central part of the province dairying has become so important that the government has established under the Department of Agriculture a number of coöperative creameries. Between the Saskatchewan and Churchill rivers mixed farming is much more common than the growing of wheat alone, and oats, barley, rye, flax, potatoes, and garden vegetables of the finest quality are raised. The cattle industry is increasing all over the province. The live stock branch of the Department of Agriculture each year purchases thousands of heifers and cows, which are sold to the farmers of Saskatchewan on very easy terms. North of the Churchill River lies a little-settled region covered for the most part with forests of spruce, and dotted here and there with lakes, of which the largest are Athabaska (2,842 square miles), Reindeer (2,437 square miles), and Wollaston (996 square miles).

Except when the chinook winds modify the temperature, the long winters are severe, though the cold is made endurable by the dryness of the air.

About one-half of the people of this great province are of British descent and many others are from the United States and various European countries. One of the most interesting groups is the Dukhobors, who are frequently called "Russian Quakers" because their religious beliefs resemble those held by the early "Friends" of England and the United States. An industrious, mild, thrifty people, their more radical members have nevertheless frequently given trouble They are pacifists and non-resistants, and do not recognize obedience to government as a duty. In Russia they were persecuted and driven from one province to another, until in 1899 they secured permission, through the influence of Count Tolstoy, to emigrate to Canada. There are now about 15,000 of the sect in Saskatchewan, British Columbia, Alberta, Manitoba, and Ontario.

Less than one-third of the population of the province live in cities, the chief of which are Regina (the capital), Moose Jaw, Saskatoon, and Prince Albert. But as manufactures, especially of lumber products and flour, are beginning to develop, the towns are growing rapidly. The provincial government has adopted a system under which it owns and controls the long distance telephone lines and controls and supervises all other lines.

One of the outstanding features of Saskatchewan's agricultural history is the growth of coöperation among the farmers. Flourishing coöperative organizations now exist for the storage and marketing of grain, for dairying, wool marketing, potato growing, cattle sales, insurance, and the purchase and distribution of farm supplies.

Like the rest of the Canadian Northwest, Saskatchewan was originally a part of the possessions of

the Hudson's Bay Company, known as Rupert's Land. The region was still unsettled when it was acquired by the Dominion of Canada in 1869; but with the completion of the Canadian Pacific Railway in 1885, settlers began to move into the region. Population increased until in 1905 the province of Saskatchewan, formed from a part of the old territory of Assiniboia, was organized. There are about 11,000 Indians in the province, mostly Crees. In 1885 they joined the halfbreeds in a short-lived rising against the government under Louis Riel, who had headed a similar rebellion in the Red River district in 1869. The rebels were quickly subdued and Riel was hanged for treason (*see* Red River).

The province takes its name from the Saskatchewan River, and in the Cree language means "rapid river." With its tributaries the Saskatchewan drains an area of nearly 160,000 square miles. The river proper (about 240 miles), with the South Saskatchewan, has a length of about 1,100 miles; it flows east through the middle region of the province and empties into Lake Winnipeg. With the Nelson River, which flows out of Lake Winnipeg, the Saskatchewan forms the most important river system emptying into Hudson Bay. Shallow draft steamers can ascend from near its mouth to Edmonton on the North Saskatchewan, a distance of 850 miles.

SAS'SAFRAS. In addition to the "sassafras tea," taken as a spring "tonic," this shrub or tree is useful for the aromatic oil from its roots used as a flavoring for medicines, stick candy, etc. It is found from Massachusetts to Florida and westward throughout the Mississippi valley, often in dense thickets, for a single tree if allowed to spread will soon be surrounded by a flourishing family sent up from its roots. The sassafras grows rapidly, reaching a height of from 30 to 50 and occasionally 100 feet, and is rather picturesque with its irregular branches and flat-topped head. The leaves are of three distinct shapes, oval, "mittens"—oval leaves with a lobe at one side in just the right place for the thumb—and double mittens, with a thumb on each side. In the autumn the sassafras is very beautiful, for its foliage turns all colors of the sunset—purple, red, and golden, while dark blue shining berries appear set on coral club-shaped stems. The berries are usually eaten by the birds before they are ripe. The leaves, bark, wood, and roots all have a pungent flavor. The wood is light and tough and is used for posts, barrels, and small boats, because it does not rot in moist soil or water.

Scientific name, *Sassafras officinale* (Laurel family). Bark thick, dark red-brown, deeply cut into irregular broad ridges. Wood dull orange-brown, soft, coarse-grained. Leaves alternate on slender petioles, 4 to 6 inches long; 1 to 3 lobes divided by broad sinuses; margins entire. Flowers inconspicuous, greenish-yellow, growing in loose racemes; blooming in May.

SATURN. This ancient Roman deity has been identified with the Greek god Kronos, who, it was said, after his dethronement by Zeus fled to Italy and there established his reign, known as the "Golden Age" of Saturn (*see* Zeus). But the name Saturn comes from a Latin word meaning "to sow," and, unlike Kronos, he was a god of agriculture who taught his people to till the soil. He is represented with a sickle in his hand. His wife was Ops, the goddess of plenty. In honor of Saturn, a great yearly festival, called the "Saturnalia," was held in December after the sowing of the winter grain was finished. This was a time of games and feasting; presents were exchanged, including especially wax candles and dolls; distinctions of rank were laid aside, and liberties were allowed even to slaves. It was formerly believed that the celebration of Christmas, which comes at about the same time, was introduced by the Church to displace the pagan license of the old Saturnalia.

In astronomy, the planet Saturn is the sixth major planet in distance from the sun, and is distinguished by its magnificent system of rings and satellites. (*See* Planets.)

SAULT SAINTE MARIE (*sǫ sănt mä-rē'*). Lake Superior's outlet into Lake Huron is the angry little Saint Mary River, which is 63 miles long. It flows in a southeasterly direction through the one-mile-wide channel which here separates Canada from the Upper Peninsula of Michigan. The level of Lake Huron is some distance below that of Lake Superior, and in making the descent the river drops 20 feet in a mile, forming rapids (the *Sault* or "rapids" of Saint Mary) impassable to lake vessels. The Lake Superior region was thus barred from the seaboard until the first ship canal was built around the rapids in 1855, overcoming the difference in level by means of its locks and enabling vessels to pass from the one lake to the other. Today there are two canals at the "Soo" (as it is popularly called); one on the north or Canadian side of the river, and the other on the American side.

The original American canal was completed in 1855 by the state of Michigan, and transferred to the United States government in 1882. The present canal is about two miles long, but there are 30 miles of dredged channel leading to it from the Huron side with a depth of 22 feet at mean low stage. The canal has four locks, ranging in width from 80 to 100 feet, in depth from 22 to 30 feet, and in length from 800 to 1,350 feet. A jackknife bridge, one of the largest bascule bridges in the world, spans the American canal. Though the canal is ice-free only eight months in a year, this outlet for the ore and grain of the Northwest carries more cargo annually than the Panama and the Suez canals combined. (For picture of locks, *see* Superior, Lake.)

On the Canadian side a canal with locks for small boats was built by the Northwest Fur Company as early as 1798, but it was destroyed in 1814 by American troops. The present Canadian canal was completed in 1895; it is $1\frac{1}{8}$ miles long, and has a lock 900 feet long and 60 wide. Both canals are free, and vessels go through either the Canadian or American locks, as is most convenient.

These two artificial links in the Great Lakes system complete the water chain or highway by which vessels can sail continuously from Duluth on Lake Superior to the Atlantic Ocean (*see* Great Lakes; Welland Ship Canal). The "Soo" carries more freight tonnage than any other canal in the world, and in some years more than the Suez and Panama canals combined, even though navigation is closed by ice for four months. Coal makes up the bulk of the westbound cargoes, and iron ore and grain most of the eastbound. About 15,000 vessels pass through the American canal in an average year, and about 5,000 use the Canadian canal. (For picture, *see* Superior, Lake.)

Two cities named Sault Sainte Marie border the canals. The principal products of the Ontario city (population, 23,082) are iron and steel, chromium, foundry and machine shop products, chemicals, sashes, doors, and paper. The Michigan city (population, 15,847) is connected with Canada by a railroad bridge and a ferry. Its chief manufactures are chemicals, leather, lumber, and woolen products. Both cities use the water power of the rapids to generate electricity for industrial and other purposes. Founded in 1668 by Pére Marquette, Sault Sainte Marie, Mich., was the first permanent white settlement in what is now the state of Michigan.

SAVAN'NAH, GA. Historic Savannah, 16 miles from the Atlantic on the Savannah River, is the oldest and second largest city in Georgia, and one of the most beautiful in the United States. Its port, which draws materials for manufacture and export from a large and rich section of the nation, has made the city one of the leading commercial centers of the South.

Vessels from all over the world come to Savannah's wharves. The port is one of the world's largest markets for the distribution of naval stores. It is also a large cotton market. Besides naval stores, cotton, and cottonseed oil, it exports lumber, fertilizers, corn, sugar, tobacco, and other products. Its industries include fertilizer plants, lumber and wood-working mills, cottonseed-oil mills, a paper and bag factory, a sugar refinery, a cigar factory, and a seafood cannery. Turpentine, paints, and various steel products are also manufactured.

The wide, tree-lined streets are intersected at regular intervals by small parks and squares. The squares were originally intended to be points of defense against Indian and Spanish attack. Now they bloom with gardenias, camellias, and azaleas. Palmettos, magnolias, and great old live oak trees hung with Spanish moss give Savannah the name "Forest City." Monuments to Revolutionary and Confederate heroes stand in many of the parks. Old brick houses with high stoops, iron railings, and half-hidden gardens add to the leisurely charm of the city.

The Telfair Academy of Arts and Sciences contributes much to the city's cultural life. It holds art classes and loan exhibitions. Its permanent collection includes sculpture, paintings, textiles, and small art objects. Of special interest to the antique lover are the colonial kitchens and the fine old furniture. The Georgia Historical Society has a valuable collection of old books and documents. Armstrong Junior College has a School of Finance and Commerce.

Savannah was founded on Feb. 12, 1733, by Gen. James E. Oglethorpe, an English philanthropist, chiefly as a refuge for English prisoners of debt. He was assisted in planning the city by Col. William Bull, a Carolina engineer in whose honor the principal street is named.

In 1778 Savannah was captured by the British, who held it until the close of the Revolutionary War. During the Civil War it was an important Confederate supply depot and was Sherman's objective in his march "from Atlanta to the sea." The Union forces took possession of the city on Dec. 21, 1864. Population (1940 census), 95,996.

SAVONAROLA
The Reformer of Florence

SAVONARO'LA, GIROLAMO (1452–1498). "Oh, my Florence! I was in a safe harbor, the life of a friar; the Lord drave my bark into the open sea. Before me on the vast ocean I see terrible tempests brewing. The wind drives me forward and the Lord forbids my return. On my right the elect of God demand my help; on my left demons and wicked men lie in ambush. I communed last night with the Lord and said, 'Pity me, Lord; lead me back to my haven.' 'It is impossible; see you not that the wind is contrary?' 'I will preach, if so I must; but why need I meddle with the government of Florence?' 'If thou wouldst make Florence a holy city thou must give her a government which favors virtue.' Then was I convinced and cried, 'Lord, I will do Thy will; but tell me, what shall be my reward?' 'My son, the servant is not above his master. The Jews made Me die on the Cross; a like lot awaits thee.' "

In burning allegorical words such as these the Dominican friar Savonarola swept the pleasure-loving people of Renaissance Florence by the tempest of his eloquence. Appalled by the sin of the world—and disappointed in love, so it is said—he had become a friar in Bologna at the age of 22. His first attempts at preaching were failures, but gradually he gained confidence and his fame spread abroad in Italy. In 1490 he was ordered to Florence by his superiors, and was elected friar of the monastery of San Marco (St. Mark's). His Lenten and Advent sermons in the cathedral of Florence, in which he denounced the sins of Florence and prophesied speedy punishment, soon gave him such a hold upon the city as few preachers have ever had.

Appeals to the Emotions of the Florentines

In imagination we can see the shrunken figure and the gaunt face of the little hooded friar, his glowing black eyes flashing like lightning from beneath the

shadow of his cowl. His prophetic words concerning the coming "scourge of God" seemed fulfilled when Charles VIII of France crossed the Alps in 1494 and invaded Italy. The emotional Florentines seized the opportunity to expel their despot, the feeble son of Lorenzo de' Medici, and restore their republic; and under the guidance of the prophetic preacher of San Marco they entered into alliance with the French.

Savonarola became practically dictator of the city, and set about his task of giving Florence "a government that favors virtue." Day by day his impassioned words roused the people to greater and greater religious enthusiasm. Light-hearted pleasure-loving Florence became a city of Puritans. Hymns echoed through the streets where lately had sounded riotous songs. In 1497 Savonarola sent the children from house to house to collect the "vanities" of the inhabitants. These were piled high in the public square—the fancy dresses and masks worn at the carnival, immodest books and pictures, and the like—and burned at the close of a solemn procession through the city.

But powerful enemies were now arrayed against Savonarola. The friends of the Medici were plotting their return. Pope Alexander VI ordered the zealous monk to discontinue preaching because of the Florentine alliance with France, and excommunicated him. At the same time a reaction against Puritanism swept over the city. A proposed ordeal by fire between a hostile monk and one of Savonarola's disciples, to test the truth of Savonarola's teaching, came to nothing, after all arrangements were made and the people assembled.

The fickle Florentines now turned against him. His enemies gained control in the elections, the monastery of St. Mark's was stormed, and Savonarola arrested. Through the use of torture they obtained from him whatever confessions they wished. In spite of the fact that his teachings were essentially the same as those of the church, he was condemned and burned as a heretic in 1498.

SAWFISH. Fishermen in warm waters occasionally find the carcass of some sea creature floating on the surface with its abdomen ripped open and its intestines torn out. This is the work of the gruesome sawfish, a huge member of the ray family, sometimes reaching 20 feet in length. His "saw" is a flat prolongation of the snout, covered with tough skin called *shagreen*. Into its two edges are set 26 pairs of long sharp teeth, with which the fish tears the flesh from the bodies of its victims. The tail of the sawfish develops tremendous strength for driving him and his saw back and forth at this cruel task. The dissecting weapon of these monsters is often six feet long and a foot wide at the base. Their small weak mouths are set on the under side of the head, back of the eyes, as is the case with their relatives the sharks. Their front fins are horizontal, serving only to balance the fish in the water. In other respects also they are shaped like sharks.

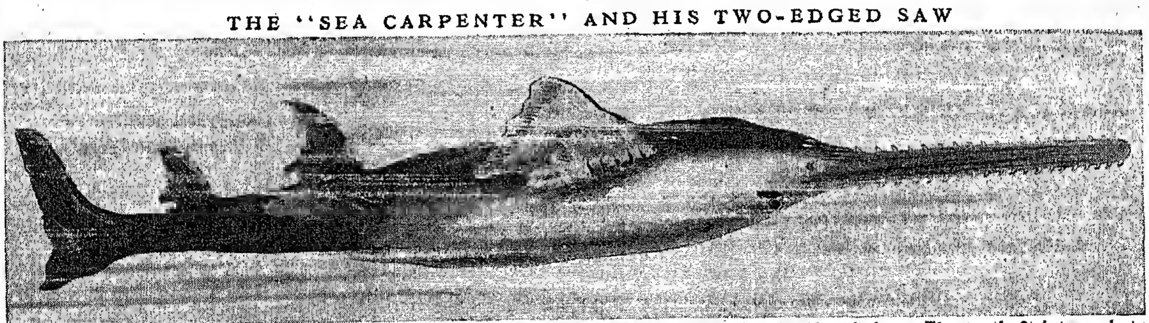
Many tales are told of sawfish attacking boats or bathers; but these stories are for the most part untrue, and are due to confusion of this animal with the much bolder and fiercer swordfish. The sawfish fights usually for food alone, and will rarely assail a creature bigger than itself. They are fairly common in the Gulf of Mexico. Sawfish will occasionally ascend rivers, and specimens have been taken from the lower Mississippi. Scientific name of the common sawfish, *Pristis pectinatus*. (*See* Fish; Swordfish.)

SAXIFRAGE. Unlike most of the spring wild flowers of the north, the saxifrage is found growing on exposed rocks and on dry hillsides. The thick scalloped leaves are gathered into a rounded tuft near the ground and the pretty white-petaled flowers are scattered in clusters on the tall, bare stem. The flowers bloom from March until May. In cultivation, the saxifrage, also called rockfoil, is widely used in rock gardens and for border planting.

Scientific name of the early saxifrage, *Saxifraga virginiensis*. The saxifrage family, differing greatly in size and habit of growth from small plants like the bishops cap to tall shrubs like the mock orange, contains about 75 genera and hundreds of species. They are found in temperate regions throughout the Northern Hemisphere.

SAXONY, GERMANY. Much of the best of Germany is to be found in the state of Saxony. This lies on both sides of the Elbe River, and has the shape of a triangle. The base of the triangle is formed on the south by the Erz Gebirge ("Ore Mountains"), which separate it from Sudetenland. The people are easy-going and kindly; the capital, Dresden, is one of the chief centers of German art; the largest city, Leipzig,

THE "SEA CARPENTER" AND HIS TWO-EDGED SAW



Notice how the teeth on the saw curve backward so as to enable the Sawfish to tear the flesh of its victims. The teeth fit into sockets in the sides of the bony snout, much as the teeth of land animals fit into their jaws.

is world famous for its university, its conservatory of music, and its chemical and printing industries. In and about Chemnitz are some of the greatest textile and other manufactures of Germany. Meissen manufactures the beautiful "Dresden" porcelain and chinawares. The fertile soil of Saxony supports a flourishing agriculture. Its Merino sheep supply the famous "Saxony" wool. Its rich mines produce coal, iron, tin, lead, silver, copper, zinc, nickel, and cobalt. Abundant water power supplements the coal fields as a source of industrial energy.

Saxony is one of Europe's most densely populated regions. Its area of 5,786 square miles is less than three-fourths that of New Jersey. It has about 5,210,000 people, or approximately 900 to the square mile. As is natural in a land which was closely associated with Martin Luther, more than 90 per cent of the people are Protestant in faith.

Started Out as Pirates

When the old Saxons first appear in history, they were redoubtable sea-pirates, ravaging the coasts of Britain and France from their homes at the base of the peninsula of Denmark. Beginning about 450 A.D., they helped to found the Anglo-Saxon kingdom of England (*see* England).

In Charlemagne's day the parent stock still dwelt by the shores of the North Sea, from the Elbe westward to near the Rhine, and from the sea southward to the low mountains of Hesse and Thuringia. Thirty years of almost incessant warfare (772–803) were required to conquer and christianize this vigorous people and make them a part of the Frankish empire (*see* Charlemagne).

Within little over a century afterward the duke of the Saxons had become king of all Germany, and revived the Holy Roman Empire (*see* Otto, Emperors of the Holy Roman Empire). And even after the kingship and imperial power had passed to other German lines, the rulers of the stem duchy of Saxony —especially Henry the Proud and his son, Henry the Lion (died 1195), who also ruled Bavaria—were among the most formidable of German princes.

Modern Saxony Has Moved

But modern Saxony has nothing but the name in common with the old stem duchy. Its very location is different, for it lies at least 150 miles to the southeast, in a "mark" or border-land conquered by the former dukes from the Slavic Wends. After 1423 this territory and the Saxon vote in the imperial electoral college belonged to the princely house of Wettin. In 1485 the land was partitioned between two sons, from whom descended an "Ernestine" line with Wittenberg as capital and the title of elector, and an "Albertine" line, with its capital at Leipzig.

The Elector Frederick the Wise (1486–1525), who was Luther's sovereign and protector, was the head of the Ernestine line. In 1547 his successor was defeated by Duke Maurice, head of the Albertine line, who thereby obtained the title of elector together with Wittenberg and other portions of Ernestine territory. The Ernestine line was long represented by a group of petty states known as the "Saxon duchies," lying in the Thuringian region to the west of the Albertine lands.

From the latter comes our present-day Saxony. It was devastated in the Thirty Years' War, but for nearly 70 years (1697–1763) its head was also (by election) king of Poland. It suffered severely at the ruthless hands of its Prussian neighbor, Frederick the Great. It was raised to a kingdom and had its territory increased by Napoleon; and then was deprived of its northern half, to the gain of Prussia, in 1815. It was again obliged to pay an indemnity to Prussia in 1866, for siding with Austria in the war of that year. But Saxony fought on the side of Prussia in the Franco-Prussian War and became a part of the new German Empire in 1871. With the rest of Germany it deposed its hereditary rulers and became a republic in 1918. In 1933 it became merely an administrative unit of the Third Reich. (*See* Germany.)

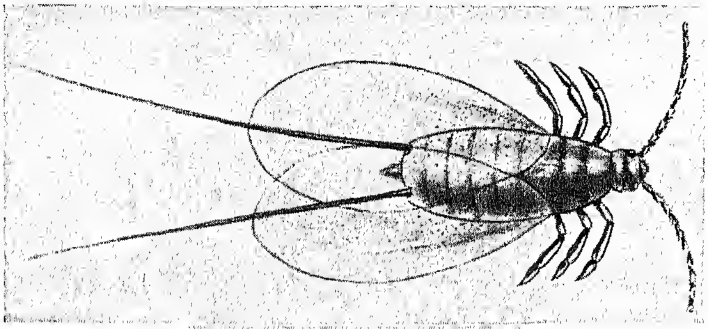
SCALE INSECTS. Some years ago the fruit growers of California were thrown into a panic by the discovery that immense numbers of scale insects of the "cottony-cushion" species were devastating their trees, threatening the flourishing groves of citrus fruits with destruction. Spraying the thousands of acres of trees with insecticides seemed in those days a hopeless task, and ruin stared them in the face. Experts dispatched to Australia, whence the pest had accidentally been introduced, brought back with them the little red-and-black spotted Australian lady-bug, which they found was the natural enemy of this pest in its native land. When these imported beetles had multiplied sufficiently, numbers of them were sent to the fruit growers, who liberated them in the groves. Swooping down on the feast, the beetles made quick work of the pest. By the aid of those beetles and other remedial measures, in less than two years the pest was so thoroughly controlled that it has never since got out of hand. When it was found that the lady-bugs starved to death as soon as the scale insects disappeared, colonies of them were kept going by breeding a supply of their favorite food. Now whenever there is an outbreak of scale insects, reserves of lady-bugs are in readiness.

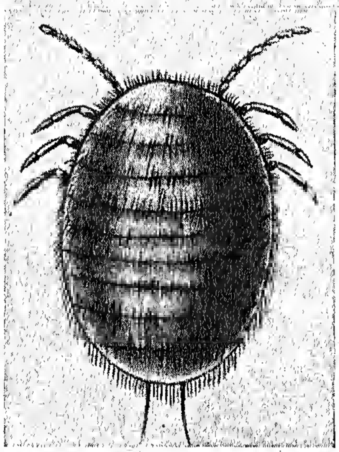
The cottony-cushion scale (*Icerya purchasi*) is only one of a number of species of the group of scale insects which are very injurious to fruit trees, shade and ornamental trees, bushes, vines, and even grasses. They may occur on any part of the stem or leaves, and sometimes even on the roots. They are called "scale insects" because they fasten themselves to a certain spot on the plant, and, with their beaks buried in the tissues of the plant, there remain feeding on the sap, protected and concealed beneath a powdery, cottony, or waxy secretion and various cast-off skins which form an oval or rounded scale.

The most troublesome scale insect in the United States is the "San José scale" (*Comstockaspis perniciosa*), which is believed to have been introduced into

this country from China. By 1890 it had spread over the greater part of California and five years later was established in many parts of the United States. It is now found all over the United States, and has proved very destructive in the best fruit-growing regions. It does not bother citrus fruits, but attacks many other trees and plants, including the apple, cherry, rose, pear, currant, gooseberry, elm, chestnut, oak, walnut, and many ornamental trees and shrubs. When this pest is present the twigs are marked by a gray scaly substance. Recently a lady-bird beetle of China has been brought to this country to aid in the fight against it. The "red scale" of the orange is a close relative of the San José scale.

THEY HELP TO TURN THINGS RED





The upper picture shows the male Cochineal, the lower the female. From the dried bodies of these insects a famous red dye is made. The Cochineal is one of the few useful scale insects.

Another troublesome scale is the "cottony-maple," often found on many other trees as well as on the maple. Its name comes from the cottony appearance of the large egg-sac which is attached to the mother scale. The "cotton" is really a wax. The "oyster-shell scale," so named because the scale resembles the shell of some kinds of oysters, occurs frequently on apple, lilac, willow, and other trees.

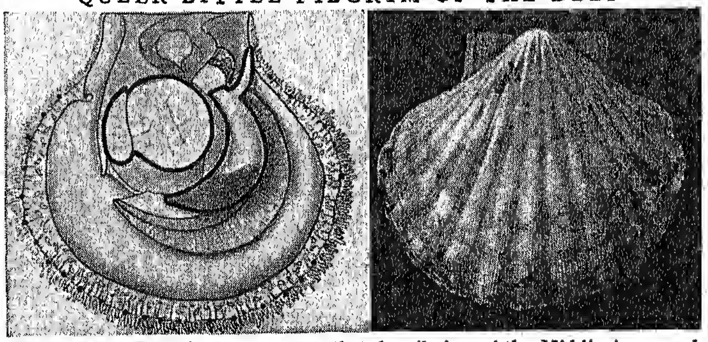
These scale insects as a usual thing are stationary except for a few hours after hatching. The males possess legs and a single pair of wings; but the females lose their six legs after molting, and thenceforth are grublike, wingless, and stationary, and are concealed under the mass of cast-off skins and a powdery, cottony, or waxy secretion. When the young are hatched they leave the shelter, and rove about the food plant for a time in search of a suitable place in which to insert their beaks and begin pumping up the sap. A few species are called "mealy bugs" more often than "scales," as they move about more freely.

Often the scales go unnoticed on the bark until they have attained great numbers, and this, together with the ease with which these insects and their eggs, when attached to living plants, can be transported long distances, has caused many species that infest cultivated plants to become distributed in almost every country in the world. Most of the highly injurious species found in the United States have been introduced from other countries, either on young trees or on fruit. Scarcely any kind of tree is free from their attacks. Certain of the species are constant pests in hothouses and conservatories.

While most of the species are pests and must be constantly combated by spraying, fumigation, etc., there are a few scale insects that are cultivated for the useful products they yield. The cochineal insect, a native of Mexico and other parts of Central America, has long been used for making a red dye (*see* Cochineal), and in Europe and Asia there are a few species of the scale insect which have been used for a similar purpose for centuries past. The lac-insect of far Eastern countries exudes a resinous substance, which when dried, pounded, washed, and purified becomes "lump-lac" or "shellac." (*See* Lacquer and Shellac.)

SCALLOP. Most "bivalves" soon settle down for life, but the scallop is a pilgrim. He does not fasten himself to rocks or timbers, or form beds on the bottom of the ocean as do oysters, but is constantly roaming from place to place. He moves by sucking water into his shell and then squirting it out suddenly with sufficient force to push himself for-

QUEER LITTLE PILGRIM OF THE DEEP



It was the shell of this little creature that the pilgrims of the Middle Ages used to wear in their hats. And it was indeed a proper symbol, for the Scallop himself is a sea traveler, pushing himself along by first sucking in and then squirting out water through his shell. On the left, the black lines indicate the delicious edible parts of this mollusk.

ward in funny little zigzag leaps. The extensive journeying of the scallop made the shell a fitting emblem for pilgrims, who in the Middle Ages wore it in their hats to indicate that they had taken long voyages by sea. It was especially the emblem of those who had made the pilgrimage to the shrine of St. James at Compostela (Spain).

There are numerous species of scallops found along the Atlantic coast of America, the chief of these being the common scallop (*Pecten irradians*) and the larger and handsomer-shelled northern scallop (*Pecten islandicus*), which is sometimes four or five inches across—more than twice the size of the common scallop. The latter has a considerably arched shell, with long deep grooves radiating from the center of the hinge which connects the two halves, like the ribs of a fan. The valves of the northern scallop shell are very much flattened and without ridges. Altogether there are about 200 living species, and many fossil ones.

The tender morsels sold in fish markets under the name of "scallops" are merely the bits of muscle with which these mollusks open and close their shells—the "adductor muscle," as it is called. This is the only part of the scallop that is eaten. Scallop shells are often used as dishes for baking and serving creamed fish. (*See also* Mollusks.)

SCANDINA'VIA. As a geographical designation the name Scandinavia is applied to Denmark, Sweden, and Norway, the region occupied by the latter two being called the Scandinavian Peninsula. The people of the Scandinavian countries are closely related in blood, language, and history, as well as geographical situation. They belong to the Low German branch of the Teutonic race, and are thus akin to the Angles, Saxons, and Jutes, who formed so important an element in the parent stock of the English people.

The Scandinavian people have spread beyond the limits of their homelands, colonizing Iceland which is now united with Denmark under the same king, and Greenland, which is a Danish colony. Elsewhere Scandinavian emigrants have become merged with the peoples of other nations, as in the case of the Northmen who settled in Normandy, England, and Russia, adopting the language and customs of the people of those countries. In recent times Scandinavian emigrants have come to the United States in large numbers, settling chiefly in Wisconsin, Minnesota, and other states of the Northwest and contributing an important and vital element to the varied racial structure of the country.

From about 850 on, Denmark, Sweden, and Norway existed as separate kingdoms; but from the Union of Kalmar (1397) until 1524 they enjoyed a united government. Denmark and Norway remained united until the Congress of Vienna in 1815. (*See* articles on the separate countries.)

The kinship of the Scandinavian peoples is evidenced by the similarity of their languages, which are still so much alike that Norwegians, Danes, and Swedes can understand one another fairly well. It was not until about 1000 A.D. that sufficient differences grew up in the parent Scandinavian tongue to constitute the three dialects which have developed into the Swedish, Norwegian, and Danish languages as they are spoken today.

The Scandinavians remained for a long time a people of action rather than a literary and artistic people. The sea was all about them, inviting them to seek fortune and adventure, while the stern and rugged land could not be conquered without a struggle. Scandinavian literature therefore begins rather late, and it is only within recent times that there have been Scandinavian writers who may be regarded as world figures.

Tales of Old Heroic Days

In the old Viking days, to be sure, tales were told and songs were sung of war and adventure, of gods and heroes, and some of those were later put into writing. Among the oldest important works that remain are the two collections known as the Eddas, of which the Elder or Poetic Edda dates probably from the 10th and 11th centuries, and the Younger, or Prose Edda, from about the 12th century. It is from the Eddas that we get our stories of Odin and Thor and the other gods of northern mythology. Besides the Eddas, there are many sagas—historical or legendary tales in prose, often interspersed with bits of poetry—first told by the sagaman or story-teller as he wandered from place to place.

The modern period in Scandinavian literature had its real beginning in the 18th century. The Danish-Norwegian dramatist Holberg (1684–1754), who has been called "the Molière of the North," and the Swedish romantic poet Tegner (1782–1846) were prominent figures in their own lands; but Hans Christian Andersen of Denmark (1805–1875), the wonderful teller of fairy tales, was the first to be adopted by the whole world (*see* Andersen).

A Series of Great Writers

As Andersen showed what the world of fairyland was like, so other great Scandinavian writers, in the latter part of the 19th century, portrayed the world of reality and delved into the problems of life. To this period belong the Norwegian Björnson, the great and much-loved novelist and dramatist, and Ibsen, who was not only the greatest of Scandinavian dramatists, but in his own day probably the most influential writer in the whole world (*see* Björnson; Ibsen). Their contemporary Strindberg, the Swedish novelist and dramatist, possessed powers in some respects as great as theirs, but his work was marred by his bitter and unhealthy pessimism. Selma Lagerlöf of Sweden, through her stories, brought about a return to the world of imagination and romance (*see* Lagerlöf). But Andersen Nexö of Denmark, who pictured the peasant life of his own country with great power and fine understanding in 'Pelle the Conqueror', as well as Johan Bojer and Knut Hamsun of Norway, who use more somber colors, have turned again to realistic studies of life as it is.

The Apples of Iduna—A Myth of Scandinavia

"Iduna had a magic casket filled with wonderful apples, which the Fates had once allowed her to pluck from the Tree of Life. These had the marvelous power of giving immortal youth and loveliness to all who partook of them. And no matter how many she took from her casket, it was always full when next she opened it."

BEHIND the stormy seas which shut in the home-land of the Northmen were many great mountains, gloomy forests, glittering lakes, and foaming waterfalls. The winters there were long and cold and dark. The sun hung low in the sky and shone for only a few brief hours in the day. Every waterway was frozen and the land was buried deep in snow.

Then summer came—short, but bright and beautiful. When the snow and ice melted in the spring, and the land grew green under the warm rays of the returning sun, it seemed to those old Northmen that some evil spell had been broken. For they thought that the icy winter was caused by a triumph of the giants of Jotunheim over the gods of heaven.

In the shining city of Asgard where the gods dwelt there was a palace for wise Odin, king of the gods, and Frigga, his queen; for mighty Thor, the god of thunder, whose magic hammer was ever ready to smite the giants; for Balder the Beautiful, the smiling god of sun and summer; and for all the others of the great gods and goddesses of northern mythology, and there, too, was the great banqueting hall called Valhalla, to which the battle-maidens or Valkyrs led the spirits of warriors who on earth died a heroic death.

Among those dwellers in shining Asgard also were Bragi, the god of poetry and eloquence, and his sweet young wife, Iduna. She was the goddess of youth, the "ever young." In the light of her warm sunny smile no one could grow old. The trees in her garden were always just bursting into bloom, the birds singing and building their nests, and the dew sparkling on the grass.

Best of all, Iduna had a magic casket filled with wonderful apples, which the Fates had once allowed her to pluck from the Tree of Life. These had the marvelous power of giving immortal youth and loveliness to all who partook of them. And no matter how many she took from her casket, it was always full when next she opened it. It was these magic apples, distributed at the feasts of the gods, that enabled them to ward off disease and old age, and kept them always vigorous, beautiful, and young throughout the ages. You can imagine how bitterly the dwarfs and giants, who had no such magic food, longed for the apples of Iduna.

Now it happened that one day Loki, the mischief-making god, fell into the power of the terrible storm giant Thiassi; and to gain his freedom he promised that he would help Thiassi steal Iduna and her wonderful apples away from Asgard.

Loki waited until Bragi was gone to earth on one of his minstrel tours. Then he sought out Iduna who was left alone, and persuaded her to go with him to a grove near Asgard, where he falsely declared he had found a tree full of apples even finer than those she treasured. In order to compare the new apples with the old, Iduna foolishly took along her magic casket with its precious contents.

The Big Eagle and the Bitter Wind

Instantly, as they came out from the walls of Asgard, a bitter wind blew upon them. The sky was darkened with what seemed the wings of an enormous eagle, but which was really the storm giant Thiassi. Swooping down, he seized poor Iduna in his terrible claws, and bore her with her precious casket of apples far away to the frozen land of the giants.

All Asgard was alarmed when Iduna disappeared. Slowly the trees in her garden turned red and gold and brown, and gusty winds blew the faded and withered leaves from the limbs. The birds grew silent and at last flew away. Snow lay deep on all the streets and groves of Asgard. The gods and heroes sat over roaring fires in their palaces and tried to keep up their spirits with loud songs and brave stories. But without Iduna's apples they grew old and gray and tired. Even the wind sighed and moaned. The sun paled and dwindled and sank so low that it nearly fell off the rim of the world.

At length Bragi found out that it was Loki who had lured Iduna out of Asgard. All the gods and heroes were so angry with that mischief-maker that he promised to do what he could to undo the harm he had so idly wrought.

Borrowing Freya's falcon plumage, he flew off into the bitter North. Loki found Iduna imprisoned in a rocky cave by a frozen sea. She had refused to give the giant Thiassi a single bite of her apples, and this was her punishment.

Changing her by his magic into a trembling swallow, Loki set out bravely on the return, clutching Iduna and her apples tightly in his falcon claws. But the storm giant Thiassi, returning from a fishing expedition, unluckily beheld them, and was soon in swift pursuit on his mighty eagle pinions.

And That was the End of the Giant!

All the gods and heroes were on the walls of Asgard as pursued and pursuer drew near. Their hearts stood still when they saw the giant eagle so close to Loki and Iduna, in their forms of falcon and swallow. Hastily they prepared a mighty fire on the walls. Loki and Iduna at last cleared the wall and sank exhausted in Asgard. Then the fire of straw and kindlings flashed up with a mighty flame, singeing and blinding the pursuing giant. He fell within the walls and was promptly killed.

Restored to her right form, Iduna gave the gods to eat of her magic apples, and they at once grew youthful again. The grass sprang up, the trees turned green, the birds came back and sang, and flower buds opened to the mounting sun. Then the goddess leaned over the wall of Asgard and looked down with pity on the cold white earth below, which also lay in the bonds of winter. That too turned green and blossomed under her glance. Men in the fields, women in their dooryards, and children at play looked up at the blue sky and said to one another: "Iduna has come back to her garden. The earth is young again. The whole world has eaten of her magic apples, and spring is here."

SCHELDT (*skĕlt*) **RIVER.** This historic little river rises in France, flows north through Belgium past Ghent and Antwerp, and enters the North Sea at Flushing. It is 250 miles long and is navigable for 207 miles. The Dutch, who possess both banks of the river at its mouth, long claimed the exclusive navigation of the lower Scheldt (French *Escault*), and demanded toll of all foreign vessels sailing upon it. In 1839, in the treaty by which Holland consented to the separation of Belgium, this right was expressly confirmed. In 1863, to free the trade of Antwerp from this burden, Belgium paid the Netherlands a lump sum of more than $3,000,000 to give up its claim to levy tolls. Other countries concerned with the Antwerp trade contributed to the fund. But frequent disputes arose over such questions as the construction of new canals, the improvement of the various channels, and pilotage and customs duties.

SCHENECTADY (*skĕ-nĕk'tȧ-dĭ*), N. Y. As the home of the General Electric Company, Schenectady is the "electrical city." In its laboratories Steinmetz and other "wizards" have produced new wonders of electrical invention. Since 1886, when Thomas Edison opened a machine shop here, the city has pioneered in making electrical goods. It ships turbines, generators, and other power equipment to all parts of the world. Another giant is the American Locomotive Company, which in 1901 took over a locomotive business that had been one of the city's great industries since 1848. From these industries comes the slogan, "Schenectady lights and hauls the world."

Because of its situation on the Mohawk River, Schenectady has been associated with transportation from its earliest days. The name comes from the Indian word meaning "at the end of the pine plains." In Indian times the site was the terminus of a portage between the Mohawk and the Hudson rivers. In 1662 it was settled by the Dutch, and became an outpost in the fur trade. In 1690 the people and their village were nearly wiped out by a French and Indian raid. Later, during the western migration, the city became a shipping center, and it was important in river commerce until the building of the Erie Canal in 1825. In 1831 the first railroad in the state was constructed between Schenectady and Albany.

Despite its industrialism, the city retains picturesque traces of its early days. Several colonial houses have been preserved. Union College, founded in 1795, is now part of Union University. The city was chartered in 1798. In 1935 it adopted the city-manager plan. Population (1940 census), 87,549.

SCHILLER (*shĭl'ẽr*), JOHANN CHRISTOPH FRIEDRICH (1759–1805). Ten years before the birth of Napoleon, the great German poet and champion of freedom was born in the duchy of Württemberg, in southwestern Germany. When Friedrich Schiller was a very little boy and studied with Pastor Moser, he made up his mind to be a preacher. He often played church, and would stand on a chair and preach to a congregation composed of his parents and sisters. But when little Fritz was eight years old his father moved to the capital where the duke lived. Here was a theater to which Fritz was often admitted as a reward for industry, and he became so fond of it that instead of playing church he began playing theater with his sisters. When the duke established a school called the Karlschule at Castle Solitude, young Schiller as a bright pupil was invited to enter it. The Karlschule was very much like a military academy. At first Schiller studied law, but later he was allowed to study his father's profession, medicine. Here he remained until he was 21, when he was appointed as surgeon to one of the duke's regiments.

While Friedrich Schiller was at the Karlschule he wrote his first play, 'The Robbers'. He wrote it in secret, frequently pretending to be sick in order to find time for writing. Every publisher to whom he applied refused it, and he finally borrowed money and had the play printed at his own expense. It was received with great enthusiasm. 'The Robbers' deals with two brothers, Karl and Franz. Franz, the younger brother, is jealous of the elder, and succeeds in duping his unsuspecting father and brother by means of forged letters in which he shows each to the other in a false bad light. Karl is disgusted with the wickedness and injustice of society, and, like Robin Hood, he becomes a leader of a band of outlaws, who avenge the oppressed. He says, "Place me at the head of an army of fellows like myself, and Germany shall become a republic in comparison with which Rome and Sparta were nunneries." Throughout the play is heard the cry for liberty. In the end Karl discovers that his attempts to right wrongs by committing new wrongs, to enforce the laws by lawlessness, and to correct violence by violence, are nothing but criminal folly.

'The Robbers' was played for the first time in Mannheim, in January 1782, and Schiller secretly left his regiment in Stuttgart in order to see the production. The duke became very angry, both on account of the republican ideas expressed in the play, and because of Schiller's departure from Stuttgart without leave. He punished the young poet with arrest, and forbade him to "write comedies or anything of that sort." But Schiller soon made his escape and fled from Württemberg in company with a friend.

For the next seven years Schiller struggled along, writing several plays and receiving small compensation for his literary products. But he was gradually attaining renown. Then a friend introduced him to the young Duke of Weimar, to whom he read part of one of his plays. The duke showed his pleasure by making Schiller one of his councilors. This position later led to his appointment as professor of history at Jena University in 1789. With the little income he now received he was enabled, in 1790, to marry Charlotte von Lengefeld, a sweet lovable young woman. Soon after he formed an intimate friendship with Goethe and in 1799 he removed to Weimar, partly in order to be near Goethe, who was director of the theater in Weimar. This was the greatest and most productive period of Schiller's life, but his health was gradually failing. In 1805 he died in Weimar, one of the best loved poets of Germany.

The two best known plays of Schiller are 'The Maid of Orleans' and 'William Tell', both of them plays of patriotism. The heroine of the first is the French peasant girl, Joan of Arc, who leads the French troops in battle and frees her country from the English invaders. In 'William Tell', which was the last play that Schiller wrote and the most popular, the story deals with the struggle of the Swiss Forest Cantons against the tyranny of their Hapsburg governors. A passionate zeal for freedom pervades the play. Schiller never visited Switzerland, but this play has been declared by critics to portray faithfully the Swiss character, scenery, and folk-lore.

Schiller was also the author of many famous ballads and lyrics which are enjoyed by all who read German. His fame belongs to the period before Germany was corrupted by Prussianism, so it shines even fresher today that it did before the German Revolution.

Schiller's chief plays were: 'The Robbers' (1781); 'Don Carlos' (1787); 'Wallenstein' (1799); 'Mary Stuart' (1800); 'The Maid of Orleans' (1801); 'The Bride of Messina' (1803); 'William Tell' (1804). His collected works, in German, numbered 15 volumes.

SCHLIEMANN (*shlē'män*), HEINRICH (1822–1890). More than a century ago a little boy in the small German town of Neubuckow in Mecklenburg sat on his father's knee listening to the wonderful tale of Troy and the great heroes who had fought there. But this ancient and glorious city, his father told him, had been so completely destroyed that not a trace of it remained.

When little Heinrich Schliemann was old enough to read the story himself, he pondered over his father's words, as he gazed at a picture of Troy in flames. At last he said: "Father, if the walls were really so strong and thick, something must be left of them. Some day I shall go to Troy and find the buried city." Many years later he carried out this resolve, and not only showed the world that Troy had actually existed, but revealed many long-hidden pages in the history of civilization.

Before he became a world-famous archaeologist, Schliemann had to pass through many hardships and struggles, yet he never forgot his dream of rediscovering Troy. It was in his thoughts when, as a grocer's apprentice, he was dealing out herring and

butter or running errands. He remembered it when as a cabin boy he sailed for Venezuela, and when, after a wreck, he was employed as clerk in an office in Amsterdam. In the meantime he managed to learn several foreign languages.

At last prosperity came to him. He engaged in the indigo trade and acquired such a fortune that at the age of 36 he was able to retire and devote himself to his long-cherished dream. In 1870 he set out at the head of a large body of laborers for the desolate region about Hissarlik in Asia Minor, which he had long believed and now proved to be the site of ancient Troy. Even more rich and interesting than he had expected were the remains he found here. After devoting several years to this work, he crossed over to the mainland of Greece and excavated the prehistoric cities of Mycenae and Tiryns, bringing to light the splendid remains of a vanished civilization of 3,000 years and more ago (*see* Aegean Civilization).

It is an interesting fact that while traveling around the world, Schliemann happened to be in California in 1850 when that territory was made a state of the union, and under the law he became a citizen of the United States. Always afterwards he took great pride in this citizenship, and it was as an American that he made his great discoveries.

SCHOOL. Every civilized nation realizes that there are no more important institutions in the world today than schools. There was a time when governments left it to parents to decide whether or not children should go to school, but that time has passed in all progressive nations. Now, compulsory education laws require that all children shall receive a certain minimum of education.

Although the American college and university had a long European ancestry, the public elementary school, with compulsory education, had its real beginning in the United States. It is now the prevailing policy of all the great world powers that educational opportunities should be free and universal.

No National School System in United States

In the Constitution of the United States there is no provision concerning education. Hence the nation has no nationally controlled system of schools. The Office of Education in the Federal Security Agency is primarily an establishment for educational research and promotion. In Alaska, where the natives are regarded as government wards, the native schools are administered by the Office of Indian Affairs in the Department of the Interior. This office also has charge of the Indian schools in the United States. Education in each island possession of the United States is directed by the American governmental department in charge of the island. The War Department administers the military academy at West Point, and the Navy Department controls the naval school at Annapolis.

Many parochial, or church, schools have been established since about 1840. Most of these are under the direction of the Roman Catholic church, although some are maintained by other denominations, particularly the Lutherans. They give both elementary and secondary preparation.

Public educational institutions are managed and financed in the main by the states, and full freedom to exist and carry on their work is granted to private and parochial schools. The Federal government itself has played an important part in education by giving princely endowments of land and money to help in the establishment of educational institutions. The land thus far given for common schools alone totals nearly 100 millions of acres. This is more than three times the area of England and nearly ten times the area of Denmark.

Great Changes in School Systems

The present school system of the United States has become exceedingly complex because of increased enrollments and a desire to meet the varied needs and interests of pupils of all classes and talents.

In the older system, education was a continuous single-track process, and all arrived at approximately the same terminus, if they stayed with the guides. Now, after a journey in common—the road of elementary education which all must take together—the paths branch out, with local stops all along the line for those who wish to go no farther, and connections that lead to many different goals.

Not many years ago the American educational system included only three units—grade school, high school, and college. Now we have at least seven distinct types: on the pre-school level, the nursery school and the kindergarten; on the elementary education level, the grade school of six grades; on the secondary education level, the junior high school of three years, and the senior high school of three years; on the higher education level, the junior college of two years, the college or university, and the graduate school, generally rather specialized.

Classes for Workers, Old and Young

Part-time, or continuation, schools offer courses, frequently in the late afternoon and evening, for both employed boys and girls and for adults. In many states attendance is compulsory, usually until the age of 16. These schools, by meeting individual needs through vocational as well as basic courses in the elementary and secondary curriculums, encourage the development of abilities and foster initiative.

Social and industrial changes led to the adoption of the platoon, or work-study-play system, by many of the cities of the United States, where it originated in 1907, and in some cities of Canada. Classrooms, gymnasiums, workshops, and laboratories are in use the whole day, since the platoon school has two fully organized sections that carry on the regular work of the first eight or nine grades.

In parental schools, children who present unusual problems in discipline and learning receive special help in their tasks of adjustment. Teachers, by meeting the needs of these pupils sympathetically through play and work, have successfully directed

them to overcome difficulties in temperament and have fostered study interests.

In addition to these types of schools there are normal schools and teachers colleges for training teachers; reform schools for wayward boys and girls; schools for physically handicapped pupils, and for the feeble-minded; summer schools; commercial and vocational schools; correspondence schools; university extension courses; and many others. Each works in a special way towards the realization of the democratic ideal, the education of all the children of all the people. (*See* Education; Gary, Ind.; Kindergartens and Nursery Schools; Universities and Colleges; Vocational Guidance.)

SCHOOL GARDENS. "A garden for every child and every child in a garden" was the motto of those interested in school gardens during American participation in the first World War. It is estimated that at least $15,000,000 a year was contributed to the food of the country from this source. School gardens have their place in peace also, because of their important relations to several school studies.

The boys and girls learn important lessons in nature study by observing the whole cycle of growth and change in plant life through raising flowers and vegetables in the garden. They learn, also, fundamental lessons in geography, especially in the early grades, as they visit gardens and study the processes of cultivation and marketing the products.

Garden Making is Good Training

Perhaps the most important relation of the school garden is that to the home. Where boys and girls become properly interested in the school garden, they naturally desire to raise a garden in their own back yards, and perhaps to set out flower-beds and trees.

The educational effect upon the boy or girl of carrying out through the whole season plans for cultivating a garden is one of the best results of good training. The cultivation of plants requires regular attention, forethought, self-reliance, and originality to overcome difficulties. School gardens have an important relation also to industrial education, for they teach children to use implements.

The value of school gardens in education has long been recognized in Europe. They were started as early as 1819 in Schleswig-Holstein, and before 1880 had been adopted in Austria, Sweden, Belgium, and France. Many of the European governments and American cities, counties, and civic organizations subsidize school gardens and offer prizes.

SCHUBERT (*shu'bĕrt*), FRANZ PETER (1797–1828). "Whatever his eye beholds, whatever his hand touches, turns to music"—so another famous composer wrote of Schubert, the world's greatest song-writer. In his short life of only 31 years—a life of continual poverty—he produced more than 600 songs, many of them as simple in their beauty as folksongs, and others full of dramatic intensity, all poured forth from a heart filled to bursting with music.

The son of a poor schoolmaster in Vienna, Schubert showed his love for music at a very early age, and his family gave him what encouragement they could. Beginning at the tender age of five, his father taught him the violin, and an elder brother gave him lessons on the piano, until they could teach him nothing more. Little Franz—then aged seven—was sent to the choirmaster of the parish church; but he, too, after a few years found that he could teach his marvelous pupil little, and could only listen to him in wonder.

Then, when he was 11, Schubert's beautiful soprano voice secured him a place in the choir of the Austrian court chapel, and he began to receive training from the chief music school of Vienna. By the time he was 13 he had already begun to compose; his only difficulty was in obtaining enough music-paper so that he could write down his melodies.

Before he left the Vienna music school, at the age of 17, Schubert had composed a symphony. But though his friends recognized his genius, the publishers feared to accept the work of an unknown musician, and it was not until his 24th year that any of his works were printed. He supported himself as best he could by teaching. With his strength impaired by overwork, poverty, and disappointments, Schubert was unable to fight the illness which overtook him, and he died in his 32d year.

He wrote overtures, sonatas, symphonies, operas, cantatas—almost every sort of composition, in fact; but it is for his songs that Schubert is chiefly remembered and loved. He could scarcely read a poem without putting it to music. Goethe's poetry inspired a great many of his songs, among them the famous 'Erlking'. Among other favorites are several from Sir Walter Scott, and the beautiful Shakespearean songs, 'Hark! Hark! the Lark!' and 'Who is Sylvia?'

SCHUMANN, ROBERT (1810–1856). When, at the age of 20, Robert Schumann was making the great decision as to what should be his life work, he wrote to his mother, "My whole life has been a struggle between Poetry and Prose, or call it Music and Law." His father, a prosperous publisher in the German industrial town of Zwickau (in Saxony), had died, and his mother wished him to study law, as she thought it a more certain profession than music; but she yielded to her son's desire when she found that his whole soul was absorbed in music.

It was Schumann's ambition to become a great pianist; but while practicing according to a method which he himself had devised, he crippled one of the fingers of his right hand so badly that he was compelled to give up all hope of ever excelling in that line. In the end the world profited by his misfortune, for it led him to devote all his attention to composing, and as a composer he gained very high rank.

The romantic feeling which runs through most of Schumann's work is a reflection, in large measure, of the romance of his own life. He fell in love with Clara Wieck, daughter of his music teacher, who was a charming girl and a remarkable pianist. During the years when he was trying to win her, and in the year

after she became his wife, Schumann composed some of his finest music, including many delightful compositions for the piano, three symphonies, and about 150 songs. Shortly afterward he wrote his great cantata, 'Paradise and the Peri', and began his music to Goethe's 'Faust'.

Schumann's life should have been very happy, but for a shadow cast over it by an inherited tendency to melancholia. His wife's tender care and sympathy helped him through several attacks, but finally in a fit of insanity he attempted to drown himself in the river Rhine. He was rescued but died a few months later in an asylum at Endenich, near Bonn, at the early age of 46.

Nevertheless, Schumann had a very great influence on the musical art of his time. For a number of years he edited a musical journal and through his criticism encouraged the best in music. He was among the first to recognize the great genius of Brahms, Chopin, Berlioz, and other rising composers.

The VAST *and* FASCINATING *Field of* SCIENCE

SCIENCE. When you were a little child you spent much of your time in learning facts about the things around you. You felt them with your fingers, your lips, your tongue; you tasted them, you listened to the sounds they made, you lifted them. In short, you used all your senses to find out as much as you could about them.

It was a very mixed-up lot of facts you learned. Sugar is good to eat, mother's silk dress is nice to touch, milk has a pleasant taste, the mug makes a bang when it is dropped; and many such facts you added to your store day by day.

Soon you began to sort these facts in your mind. Some of them belonged together: Dolly falls when you drop her, your spoon falls when it is knocked off the table; and a hundred other such facts were put together. So you came to the notion at last that all things fall when dropped. This for you was a beginning of science, for science grows in just this way. Men first observe facts, sort them, so as to put together those that seem related, and by thinking on these things reach broad truths that cover many facts.

As a child you went on in your belief that all things fall when dropped. Of course you did not state this law to yourself in any such way, but when you dropped a thing you looked for it on the floor, not on the ceiling. You acted on your belief. Then one day perhaps you had a toy balloon and you let go of it. That did not drop but went up. It may have been many months or even years before you found enough other facts of the same sort to help you understand that if a thing is lighter than air it does not usually drop, but rises instead. So you gradually added to your scientific knowledge.

How Science Grows

Now men have found out a great deal more about falling bodies than simply that they fall. They have watched them and timed them and measured how hard they hit and have put the facts together and thought about them until they have found out certain laws of falling bodies. They have found that the apple attracts the earth quite as well as the earth attracts the apple, and they know the laws of their mutual pull. And so science grows. Science is simply all the knowledge of fact that men have found out for sure and have put in order so they can use it to find the fixed order of things and the relations of cause and effect. These they call then the laws of nature.

This knowledge is now so great that no one mind can master all of science. A single great library may have on its shelves hundreds of thousands of books full of this scientific knowledge, so that you can easily find out about anything you may want to know.

The Many Divisions of Science

Science as a whole is broken up into many parts, each a science. Biology is the science that deals with living things. It in turn is divided into Botany, the science of plants, and Zoölogy, the science of animals. These are again divided. A man may devote his life to the study of birds and then not know all there is to be known about them. Ornithology is the science that deals with birds. Geology has to do with the history, structure, and changes of our earth. Physics deals with such forces as heat, light, and electricity, and with the stuff things are made of. The History of the races of men is a science, and so are Grammar and Geometry. Indeed, just to name all the sciences into which the great mass of knowledge is divided would take pages of print. You will find the more important of the sciences treated under their names in special articles in these volumes.

The results of scientific discovery are made use of in countless arts and professions, which are usually classified as Applied Science. Among these are Medicine, all forms of Engineering, Pedagogy, Agriculture, Navigation, etc.

But science has not only put in order a mass of knowledge; it has also shown that the scientific method of thinking is very important. This may be stated briefly as thinking to correct conclusions on a basis of tried and true facts.

An illustration will help to make this clear. When the people of the United States took Cuba years ago, they needed to clean up the island and make it healthful, for it had been a center of yellow fever which had been spread from Cuba to New Orleans, Philadelphia, Boston, and other ports by sailors or other travelers. Philadelphia in one year lost nearly one-third of its population by a plague of yellow fever. No one knew the cause of yellow fever or how it was spread. To fight it wisely these things had to be learned. So American doctors went to Cuba to get all

the facts they could as to when it occurred, where, among what kinds of people, and so on. They found among other things that it was very common in swampy regions. That made them think that the germ of the disease might be carried by mosquitoes, as malaria was then known to be carried. The guess was worth testing. So mosquitoes in little cages were allowed to bite persons afflicted with the disease and, after several days, well persons. These were soldiers and doctors who offered themselves for the test. They one and all came down with the disease, and one, Dr. Lazear, died of it. Soldiers slept in swampy regions in shacks screened so no mosquitoes could get in and they did not take the disease even when they slept on beds in which persons had recently died of yellow fever. All these facts convinced the doctors that the mosquito carries the germ of yellow fever. (*see* Germ Theory of Disease; Mosquito.)

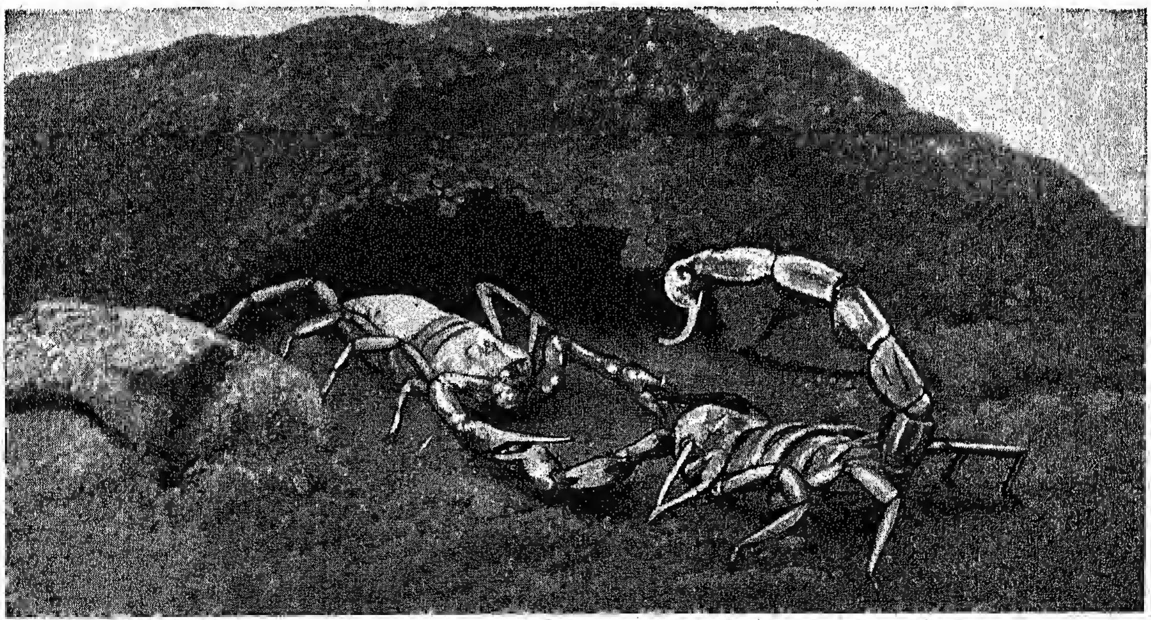
So this problem was solved by collecting facts, making a guess as to the solution, collecting more facts by experiment to test the guess, reasoning on all the facts to a correct judgment. Such is the scientific method. Scientists think all problems should be so settled, and not by whim, fancy, or prejudice.

SCORPION. Scorpions are near relatives of the spiders, for they too belong to the eight-legged *Arachnida.* But on account of their claws, they look much more like tiny lobsters or crawfish with very slender tails. At the end of that tail is the scorpion's chief distinction—his sting, a very hard sharp curved needle with a tiny hole near the tip through which he pours the poison stored in the last joint of his tail. When a scorpion has clutched its prey in its great powerful claws, it curves its tail over its head and plunges the paralyzing sting into the helpless creature.

Observers say that scorpions are most deliberate and careful in finding the right place in the captive's body to sting. Random thrusts might break the delicate sting against a beetle's tough armor, so they carefully feel for a soft place and then introduce the needle. The poison is sufficient to kill small creatures and to cause human beings much pain; it may even produce death in case a person is weak when he is stung. The scorpion is always careful to keep his formidable weapon out of harm's way by holding it aloft over his back.

Scorpions are found only in warm countries. They range from one to eight inches in length. Some small species are rather common in the southern portions of the United States. During the day most scorpions lie hidden under stones and logs, or in holes, and are rather slow and torpid. At night they come out and are very quick and active. Their food consists of small insects, spiders, lizards, toads, slugs, snails, and even small mammals such as mice and shrews. They are not vicious unless disturbed and seldom do harm to man. The mother scorpion brings forth her young alive and carries them about on her back for some days. Unlike insects, scorpions resemble their parents when born and undergo no "metamorphosis." Scorpions have lived for a long time on the earth, for fossil remains, differing but little from modern types, are found in rocks of ancient formation.

HOW SCORPIONS SAY "HOW DO YOU DO"



When two Scorpions meet—provided they are on friendly terms—they sometimes "shake hands" in a way that grotesquely suggests the handshake of human beings. But among the best families in Scorpionland, this is only part of the ceremony; for each curves its tail over its back, as one of them is already doing here, until their tails cross, when they hook their tips around each other.

The BONNIE HOMELAND of the SCOT

View across Loch Lomond—the Largest of the Famous Scottish Lakes

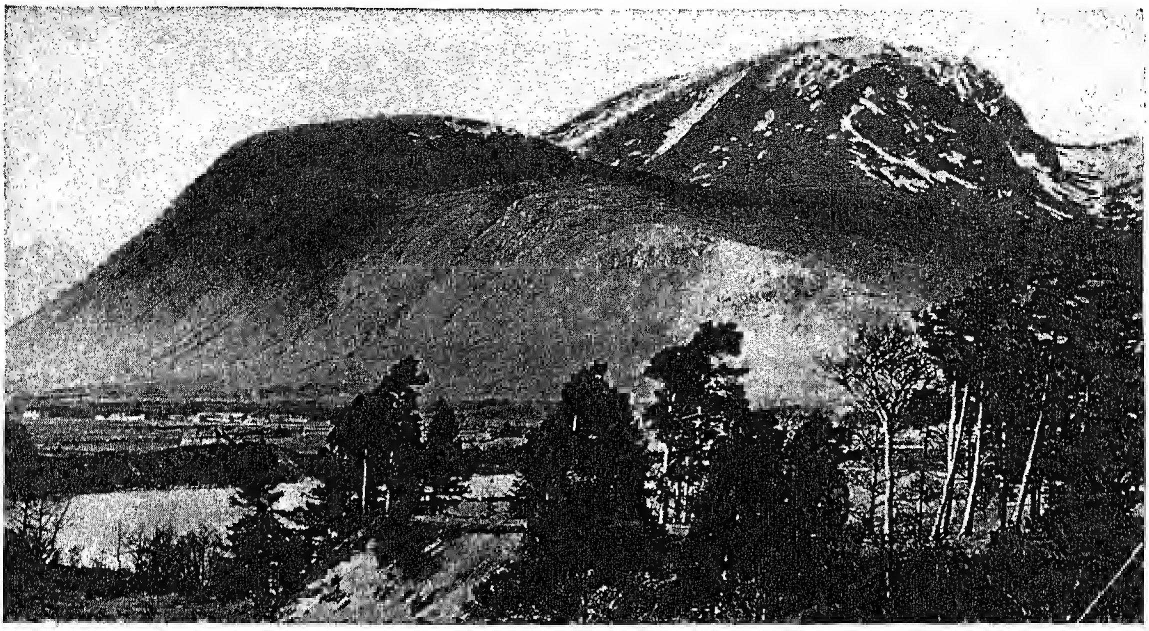
SCOTLAND. The northern third of the island of Britain, which for a thousand years has been known as Scotland, is divided geographically into three parts, the northern Highlands, the central Lowlands, and the southern Uplands. The northern Highlands average about 1,500 feet above the sea and are mostly heather-covered rocks where nothing can be grown. In the little valleys between the hills a few sheep are pastured. Much of the country is used today for hunting preserves, and is a country where the red deer can still be stalked and grouse shot. The Highlands of Scotland are really the holiday country of the wealthier English, and when Parliament adjourns on August 12 every year, the grouse hunting season opens in Scotland. The Lowlands represent fairly good farming country, where wheat, oats, barley, etc., are grown and where a considerable dairying business is carried on. The Scottish people are good farmers and know how to make economical use of their land. In few parts of Europe has farming improved so rapidly in the last century as in the Lowlands of Scotland. The southern Uplands are less fertile, and while various crops can be grown sheep-raising is the chief occupation.

This is a Scotch Highlander in typical Highland dress, with his plaid and his brooch, his kilt and his bonnet, saucily cocked on the side of his head.

The whole coast-line of Scotland is very irregular, and the western part fairly bristles with a fringe of "firths" (fiords) and peninsulas and islands. The Orkney and Shetland Islands to the north, and the Western Islands or Hebrides Islands are all parts of Scotland. The greater portion of the mainland is mountainous. The rugged Grampian Mountains (average height, 2,000 to 3,000 feet) separate the Highlands from the Lowlands and have at their western extremity Ben Nevis ("ben" means "mount"), Scotland's highest peak (4,406 feet). Southward are lesser peaks and groups, of which Ben Lomond (3,192), although not the highest, is the most famous. The Cheviot Hills (highest peak, 2,658 feet) lie on the southern border. Scotland is dotted with numerous lakes, of which beautiful Loch Lomond is the largest and most famous in story. Loch Ness and Loch Lochy, with their connecting waters, were joined in 1803 by canals with locks so as to make a continuous waterway (the Caledonian Canal) 62 miles long across northern Scotland, from Moray Firth, an arm of the North Sea, to the Firth of Lorne, which opens to the Atlantic. Vessels of 500 to 600 tons, usually fishing boats, pass through the canal, and it is a favorite route for tourists in the summer season. Scotland's total land area, including that of its 186 islands, is 29,797 square miles, and the population is 4,850,000. (For map, *see* England.)

Seventy-five per cent of the population today is concentrated in a small district centering in Glasgow, the great factory city of the southwest and the largest city in Scotland, with 1,090,000 population. In that neighborhood are great coal mines that produce about 40,000,000 tons of coal a year, and in and around Glasgow great ship-building industries have grown up, the most important in the British Isles. Machinery, jute, linen, wool, etc., are also manufactured in this same neighborhood and elsewhere in

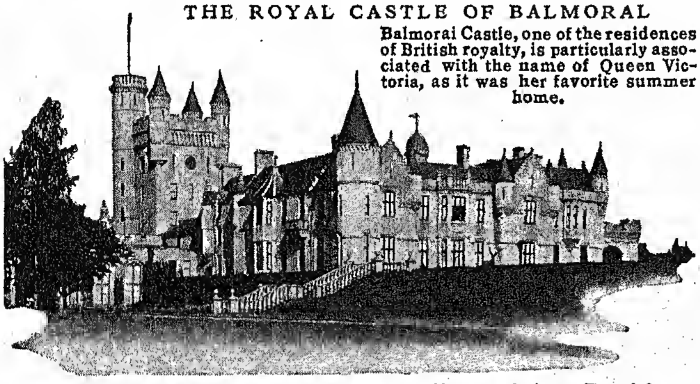
THE GIANT OF SCOTLAND'S MOUNTAINS



This is the famous Ben Nevis in Inverness-shire, Scotland. It is the highest mountain in the British Isles and if you should follow the bridle road up to the summit—it only takes two or three hours—you could see from there every good-sized mountain peak in the whole of Scotland. Ben Nevis is not only tall—4,406 feet above sea level, but burly—about 30 miles around. "Ben," by the way, isn't short for "Benjamin," it's Scotch for "mountain."

Scotland. As one travels southward from Glasgow, on the great Caledonian Railway, one rides for an hour past great massed factories, whose chimneys and smoke obscure the sky. Whiskey, preserves, and chemicals are important manufactures in addition to the textiles and iron and steel. Fishing also is one of Scotland's great industries. Besides Edinburgh (the capital, 440,000) and Glasgow, the chief cities are Dundee, Aberdeen, Paisley, Leith, and Greenock.

THE ROYAL CASTLE OF BALMORAL



Balmoral Castle, one of the residences of British royalty, is particularly associated with the name of Queen Victoria, as it was her favorite summer home.

The Scottish people have been handicapped in many ways. They have little good land, the rainfall over most of the country is so great as to interfere with agriculture, the arms of the sea and the mountains cut off the various parts of the country one from another. Few countries have conquered such natural disadvantages. The Scots have learned to make the most of what they have. They are an industrious, clever, and thrifty people, and not only build ships for other nations but man them. It is said that, in any part of the world, if you go below the hatchway to the engine room and call out, "Mac, are you there?" a Scottish engineer will poke up his head and answer.

It is also said that the road a Scotchman likes best is the highway down to London; and it has been true for a century—and is more true now than ever—that the best young talent in Scotland goes south to London, and that Scottish talent recruits English business and politics. The Scots have gone also—and continue to go—to the British colonies and to the United States, where they are nearly always successful.

Racially it is hard to distinguish the Scot from the northern English; they look alike and talk much alike, and have the same manners. Scottish skulls do not prove them to be very different in race. Probably the Scots more largely than the English are descended from the early peoples who spoke Celtic dialects, but they have some Saxon and Danish and more Norman ancestry than has sometimes been assumed.

Scotland's early history is a tangled web of tribal warfare and clan struggles, and has little of the uniformity of development and symmetry that belongs to English history. The Romans never conquered the Caledonians or Picts who inhabited this part of Britain. At the end of the 5th century a people called

MAJESTIC ARCHITECTURE NOT BUILT WITH HANDS

If you ever go to Scotland, you mustn't fail to visit the wonderful Fingal's Cave on the Island of Staffa off the Scotch coast. The pillars you see were made by the cooling of an ancient stream of lava that ran out into the sea and made the island. The long arched cave (it runs back for 227 feet and rises into a vault 66 feet high) makes you feel as if you were looking into the underground cathedral of some creatures of the underworld. The play of color on the basalt walls brings out every tint of warm red, brown, and rich maroon, and the seaweeds and the lichens paint the walls in green and gold. You might imagine there was a pipe organ too in this cathedral, for always there comes from it the low, rich murmur of the sea, varied in times of storm by a sound as of thunder, as the air within, compressed by the force of the wind, rushes out again.

Scots came from Ireland and settled western Scotland and in the 9th century Picts and Scots united in a single kingdom under Kenneth MacAlpine, king of the Scots. When the Normans conquered England, the successors of William of Normandy made claims to feudal lordship over the kings of Scotland, but these claims remained vague. Richard Coeur de Lion sold his claim upon Scotland for money to go crusading. Edward I of England took advantage of the disputes between heirs to attempt to unite Scotland with England. His plan was statesmanlike but took no account of Scottish nationalism. Sir William Wallace resisted him at Stirling Bridge and became the great hero of Scotland. Wallace was, however, defeated at Falkirk (1298), and was finally captured and put to death. Robert the Bruce, grandson of one of the earlier claimants to the throne, renewed the war, and after many misadventures (*see* Bruce, Robert) was able at Bannockburn, in 1314, to drive the army of Edward II headlong into England. Scotland thus regained her independence, and in the wars which England fought with France in the 14th and 15th centuries (*see* Hundred Years' War) Scotland sided with France. There were many border battles, in most of which the Scots got the worst of it; Halidon Hill (1333) and Flodden Field (1513) are two of these battles most renowned in song and story.

Scotland under the lead of John Knox (*see* Knox, John) early adopted the Calvinistic or Presbyterian form of the Protestant Reformation; but Mary Queen of Scots remained a Roman Catholic and had a claim to the throne of England. She was driven out of Scotland into the hands of Elizabeth of England, who afterward allowed her to be executed (*see* Mary Stuart, Queen of Scots). Mary's son James VI was brought up in the Presbyterian faith. On Elizabeth's death he succeeded to the throne of England also as James I, uniting the crowns of the two nations but not the governments.

When Charles I, son and successor of James, attempted to impose upon Scotland the English episcopal form of government, a servant maid named Jenny Geddes threw a stool at the ritualistic bishop in St. Giles Church, Edinburgh, and so began the successful Scottish rebellion, or Bishops' Wars (1637). The advance of the victorious Scottish army onto

English soil made it possible for the Puritan party in England to maintain the rights of the English Parliament against Charles I. Eventually the Scottish army and the army of Parliament joined hands in war against Charles (1642). When Charles was forced to throw himself into the hands of the Scots after the battle of Naseby (1645) they turned him over to the English. His execution in 1649, however, produced a reaction in Scotland and his eldest son was welcomed in Edinburgh as Charles II. Cromwell marched into Scotland, defeated the Scottish at Dunbar (1651), drove Charles II out, and governed Scotland as a conquered nation. The restoration of Charles II in 1660 gave Scotland again separate government. The overthrow of the last Stuart king, James II, in 1688–89, was disapproved in the Highlands, and for a century afterward there were adherents of the fallen Stuarts in that part of the country. Twice, in 1715 and 1745, there were formidable "Jacobite" uprisings.

The Act of Union in 1707 brought Scotland and England under one government. "There are few instances on record," says a wise English historian, "in which a nation passed in so short a time from a state of barbarism to a state of civilization." Barbarism is probably too strong a word, but the Scots up to that time had lacked much of that law and order and peace which had become characteristic of the English kingdom. An admirable elementary and secondary school system—superior to that of England—has been established, while the Scottish universities of Edinburgh, St. Andrews, Glasgow, and Aberdeen hold high rank the world over.

In the 19th century Scotland underwent a great industrial change. Coal and steam, railways and machinery, made Scotland over. The Scots were a people who took to machinery and the large-scale business that followed machinery. Scotland became more important than it had ever been before. Its population increased. Queen Victoria's preference for her northern realm as a summer residence was much appreciated in that country. More and more the politicians of Scotland found careers in the Parliament at Westminster, and the past 50 years of British history give color to the Scottish saying, when they are twitted about dependency, that they "rule England." While the Scots today love to recall Sir William Wallace and Robert the Bruce, it is because of their feeling for the past rather than from any national feeling against union with England. The poetry of Robert Burns and the romances of Sir Walter Scott have given the Scots a new pride in their country and raised the esteem for Scotland all over the world, and in such matters as local government, their national church (Presbyterian), and national law, they are as completely self-governing as they could desire.

It is a curious fact that a people as talented as the Scots have produced so few poets, musicians, painters, and sculptors. In a general way they seem to be a practical people, more interested in business and politics than in artistic activity. Yet they have been a nation of theologians and metaphysicians; the visitor to Edinburgh finds the statues of their great theologians on every corner. It has been said that every Scotchman is a philosopher. Knowledge and reading are more widely diffused in Scotland than in any other part of the British Isles, and Edinburgh and Glasgow are the home of great bookshops. The average Scotchman knows the lore of his country, and its border ballads; but he is at the same time a good Britisher.

SCOTT, ROBERT FALCON (1868–1912). On the 29th of March, 1912, three dying men lay in a little tent in the frozen Antarctic continent—three heroic men who had been to the South Pole. On their way back they had been caught by a terrible blizzard within 11 miles of a depot in which food and fuel awaited them. While the fearful gale beat and howled outside the flimsy shelter, their commander raised himself in his sleeping bag and feebly wrote these words: "We shall stick it out to the end, but we are getting weaker of course and the end cannot be far. It seems a pity but I cannot write any more.—R. SCOTT." Some time later he added the last entry, "For God's sake look after our people."

ROBERT FALCON SCOTT

This photograph of the heroic explorer was taken on the ill-fated expedition which cost him his life.

So ended in tragedy the English exploring expedition under Capt. Robert F. Scott which had gone out two years before with such high hopes. They had reached the South Pole, indeed, on Jan. 18, but not first. For Roald Amundsen, the Norwegian explorer, had arrived there on Dec. 16, 1911, a month earlier.

The story of the desperate struggle to cover the 1,800 miles from the Pole back to their base, as told in Captain Scott's diary, is one of the most heroic and pathetic narratives in history. Soon after leaving the Pole one of the party succumbed to the hardships.

Then gallant Capt. Lawrence Oates became disabled. He could go no farther, and it was death for his comrades to stay with him. So bidding them goodby, he calmly walked out into the raging blinding blizzard to meet his death.

Even this sacrifice was in vain. When the survivors at last knew that the end was near, Captain Scott wrote his imperishable farewell to England, in which he said: "I do not regret this journey, which has shown that Englishmen can endure hardships, help one another, and meet death with as great fortitude as ever in the past. We have been willing to give our lives for this enterprise, which is for the honor of our country."

And to his wife he wrote: "Make our boy interested in natural history if you can. It is better than games. Keep him in the open air. Above all, you must guard him from indolence. Make him a strenuous man. The great God has called me. Take comfort in that I die in peace with the world and myself and am not afraid."

Scott entered the English navy at 14 as a cadet. In 1901 he headed an expedition to the Antarctic in the *Discovery* which discovered King Edward VII Land and did notable scientific research work. His second and last expedition started in 1910 in the *Terra Nova*. It also accomplished much valuable research work. Captain Scott's records were recovered when his body was found eight months after his death. There in the everlasting snows a cairn has been raised and a cross surmounts the last resting place of these gallant martyrs of science. (*See* Polar Explorations.)

The LAME SCOTS LAD *Who Became a* GREAT STORY-TELLER

SCOTT, SIR WALTER (1771–1832). A bold hard-fighting clan were the Scotts of old, whose boast was that—

> By the sword they won their land,
> And by the sword they hold it still.

What would "auld Watt of Harden"—that ancient chieftain of the clan—have said if he could have known that the greatest glory of his line would be the lame son of an Edinburgh lawyer? For it was "auld Watt's" namesake of six generations later that saved from oblivion the ballads and legends of the Scottish Lowlands and the Border country, and made the almost forgotten past live again.

CHIEF EVENTS IN SCOTT'S LIFE

1771.	Born at Edinburgh, August 15
1779.	Entered High School at Edinburgh
1783.	Matriculates at Edinburgh University
1786.	Enters his father's law office as apprentice
1792.	Admitted a member of the faculty of advocates
1797.	Married, on Christmas Eve, to Charlotte Carpenter
1799.	Appointed sheriff-deputy of Selkirkshire
1805.	Publishes 'Lay of the Last Minstrel'
1812.	Begins building Abbotsford
1814.	Completed and published 'Waverley'
1820.	Created baronet
1826.	Failure of Ballantyne firm leaves him owing $650,000
1832.	Dies September 21; buried at Dryburgh Abbey

Walter Scott was born into an old family of the Border country, a turbulent area where Scotsmen and Englishmen had fought for centuries. Among his forebears were "saints and sinners, scholars and sportsmen and men-at-arms, barons and sheepfarmers, divines and doctors of medicine, Whigs and Jacobites, Cavaliers and Quakers"—as the boy early learned from the tales of his grandmother. When Walter was only 18 months old, he had lost the use of his right leg through an attack of what is now believed to have been infantile paralysis, and he had been sent from his Edinburgh home to live with his grandparents on their farm of Sandy Knowe near the River Tweed. The grandmother found an eager listener to her stories of Scottish history and her ballads of the Border. Thus were sown the seeds of Scott's interest in literature and in old times and deeds. These things so excited the boy's imagination that he himself began to write poems, and to make a collection of ballads.

His career at the Edinburgh High School, which he entered at the age of 8, was not marked by brilliance or scholarship, but young Scott became the favorite story-teller of his group and was also held in esteem for his cheerful pugnacity; he was a formidable fighter despite his lameness. His years at the University of Edinburgh were marred by illness, but he acquired a working knowledge of Latin, and learned enough French, German, Spanish, and Italian to enable him to read his favorite authors in their original languages. In 1786 he entered his father's law office as an apprentice, signing indentures for a term of five years. At 21 he passed his examinations for the bar and became an advocate.

By this time he was a "braw" young man. He was tall and broad of shoulder, with a barrel-like chest and arms of remarkable strength. Lame though he was, he could walk 30 miles a day. Because his clients were few, he had plenty of leisure time to learn more of Scotland, and he made numerous excursions into the Border regions, there making friends with the people, learning their stories and their folk ballads.

When he was 26, he met and married Charlotte Margaret Carpenter, or Charpentier, the handsome daughter of a French refugee—a marriage marked by singular devotion and affection until her death nearly 30 years later. At 28 Scott was appointed sheriff-deputy of Selkirkshire, with a salary of $1,500 a year. This, added to his earnings as a lawyer, and his own and his wife's money, allowed him better than a comfortable living. He continued collecting ballads, and in 1802 brought out two volumes of his 'Minstrelsy of the Scottish Border', which preserves for us some of the finest traditional songs of the Border country.

In 1805 Scott published the first of his narrative poems, 'The Lay of the Last Minstrel', which grew out

of his interest in Scottish balladry. The 'Lay' became enormously popular and sold at an unheard-of rate. This success determined Scott to make literature his main business, though he continued to perform the duties of sheriff and also took another well-paid office, that of Clerk of Sessions. But so great was his capacity for work that he was able not only to attend to these duties but, in addition, to turn out a greater volume of literary work than any other writer of his time. His serious business was the editing of sets of Dryden, Swift, and others. For relaxation he wrote 'Marmion' (1808), which was even more popular than the 'Lay', and 'The Lady of the Lake' (1810), which brought many tourists to the Trossachs.

SIR WALTER SCOTT AT FIFTY

Save for his lameness, Scott was the very ideal of a Scottish laird—tall, robust, and handsome, with expressive gray-blue eyes and light brown hair. This is an engraving after a portrait by Raeburn.

In the winter and spring of 1814 came the turning point in Scott's career. He was the most popular of English poets, but in the next few years his popularity was to be overtaken by that of a greater poet, Lord Byron, and Scott foresaw this. Moreover, he needed money. He had a wife and four children, and in 1812, on a large tract of land, he started to build Abbotsford, a fine mansion in the Scottish baronial style. How was he to increase his earnings?

Turns from Poetry to Prose

While he was seeking the answer to this question, he chanced one day to go into the garret to get his fishing tackle. There he found, tucked away in an old desk, the first chapters of a historical novel he had begun years before but had put aside on the advice of friends. Now he speedily finished the story and gave it to the world in 1814 as 'Waverley; or 'Tis Sixty Years Since'. Its amazing success prompted Scott to continue with the famous series of novels named after it, and thus to create the pattern of the "historical novel." The series was published anonymously, in part because Scott feared that novel writing would be held unbecoming to a clerk of the court, and in part because of his love of mystery. Not until 1827 did he admit authorship of the 'Waverley' series, which continued to come out through the years while Scott was producing under his own name a flood of tales, historical works, and articles. It seemed impossible that any man could do so much.

Scott was now 43. He would rise at five o'clock, dress himself in breeches and shooting jacket, and be in his study by six, where he worked with great concentration and speed until nine or ten. The study door was always open, his dogs always near his feet. He had to feel the life of the house going on about him as he wrote. Breakfast at ten, with all of his family, was an established ritual. His daughter Sophia was 15 at this time; Walter was 13; Anne 11; and Charles 9.

But disaster hung over this genial household. As early as 1809 Scott had bought an interest in a publishing firm founded by his friends James and John Ballantyne. Scott was to supply "copy" for the firm. It is said that Scott might have been an able business man if he had put his mind to business, but his interests and energies were centered elsewhere. In 1816 rumors of a Ballantyne crash gained strength, but Scott was able, by a loan of $20,000 from a friend, to tide the business over.

The next ten years were those of Scott's finest novels, and they were ten years in which he lived an intense, diversified life that would have killed any lesser man. Not only did he continue to perform his duties as sheriff and clerk of the court, and to write and edit vast quantities of literary material, but he kept the doors of Abbotsford open to all and entertained swarms of guests.

Fighting Against Misfortune

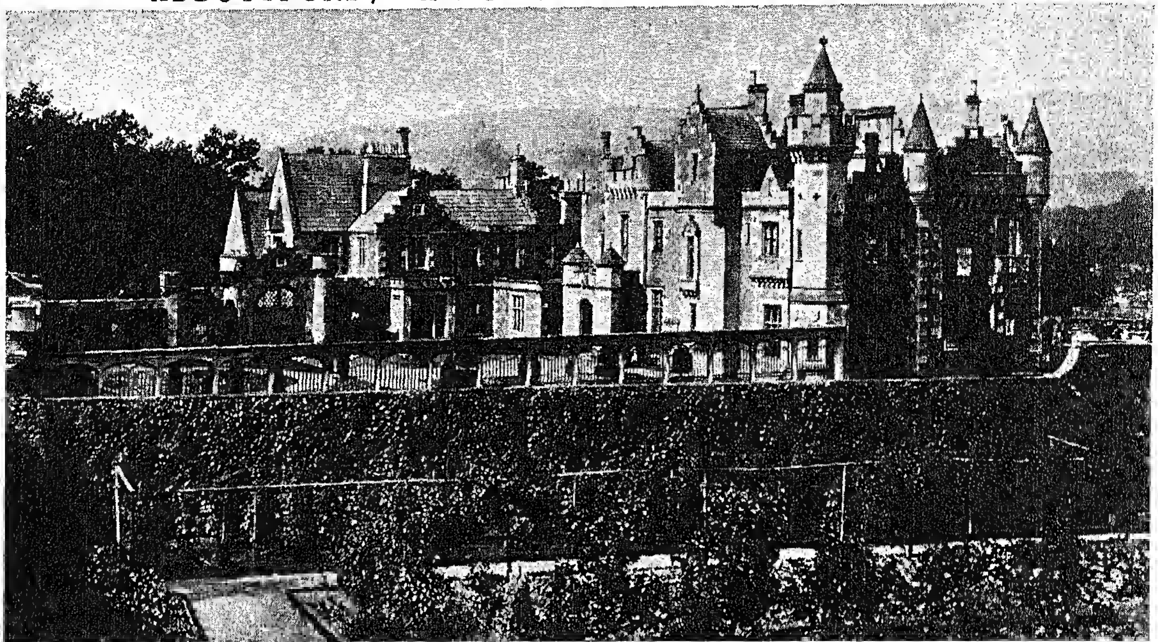
Eventually, however, the crash came, in 1826. Because Scott was a man of the highest standards of honor, he accepted his share of the liability, $650,000, and at the age of 55 set to work with a fury of energy to repair his fortunes and to protect his creditors. He wrote in 1826 in his 'Journal':

> I feel neither dishonored nor broken down by the bad—now really bad news I have received. I have walked my last in the domains I have planted—sate the last time in the halls I have built. . . . I would like, methinks, to go abroad "And lay my bones far from Tweed." But I find my eyes moistening and that will not do. I will not yield without a fight for it.

The years that followed were years of the most incredible display of fertility, under adverse circumstances, in the history of literature. Within two years he earned $200,000 for his creditors, and in the end his labors paid every penny of the Ballantyne firm's debt. The $250,000 still due at his death was cleared 15 years later by the sale of his copyrights.

But superhuman work and personal misfortunes—the death of his wife, and of his favorite grandchild—crowded upon him. It is no wonder his health broke. At 60, Scott was old and feeble. In the autumn of 1831 he sailed as guest of the British government in the frigate *Barham* to the Mediterranean in search of health. But he grew worse, and he was very homesick for Scotland. He was brought back to London, whence he sailed to the Forth, and thence home. In the great biography of Scott by his son-in-law, J. G. Lockhart,

ABBOTSFORD, "A ROMANCE IN STONE AND LIME"



The estate of Sir Walter Scott, on the River Tweed, was a small farm known as "Clarty Hole" when he purchased it in 1811. By 1826, when his financial crash came, he had spent more than $350,000 on enlarging it and building this fine home.

the account of this journey home is a deeply moving story. Scott died at Abbotsford Sept. 21, 1832, and was buried with his ancestors at Dryburgh Abbey.

Critical Estimate of the Novels

In the field of the historical novel Scott is not only the originator, but he is to this day supreme. He has had countless imitators; a few isolated works have approached his best but none has excelled it. A historical novelist must be doubly equipped: he must combine a wide knowledge of history with a real capacity for true portrayal of character. He has to recapture an alien world before he is ready to present his people as human beings. It is because Scott managed to do these two things so admirably that he stands head and shoulders above all others who have tried to write this kind of book.

It would be profitless to quarrel as to which of Scott's novels is his best; for partisan readers are to be found among even his soundest critics. In fact, during the past hundred years, reputable critics have pronounced as his finest work one or another of the following 13 books: 'Waverley', 'Guy Mannering', 'The Antiquary', 'Old Mortality', 'Rob Roy', 'The Heart of Midlothian', 'The Bride of Lammermoor', 'Ivanhoe', 'The Abbot', 'Kenilworth', 'Quentin Durward', 'Redgauntlet', and 'The Talisman'.

Scott's own favorite was 'The Antiquary', a comedy of Scottish life. The characterization is for the most part superb, though the plot is weak. Scott's stories often tend to ramble. In his preface to 'The Fortunes of Nigel' Scott says:

> I have repeatedly laid down my future work to scale, divided it into volumes and chapters, and endeavoured to construct a story which I meant should evolve itself gradually and strikingly, maintain suspense, and stimulate curiosity; and which, finally, should terminate in a striking catastrophe. But I think there is a demon who seats himself on the feather of my pen when I begin to write, and leads it astray from the purpose. Characters expand under my hand; incidents are multiplied; the story lingers, while the materials increase; my regular mansion turns out a Gothic anomaly, and the work is closed long before I have attained the point I proposed.

This is all very true. And all critics of Scott have spoken adversely of his hurried and huddled endings. When one realizes that from 1814 to 1820 Scott wrote 12 novels, and five of them in 30 months, one can only wonder at the amazing creative energy, and not be surprised at some unevenness in the composition.

Of 'Waverley', which was written to reveal the Highland and Lowland Scots to uninformed and prejudiced Englishmen, Stevenson said it contained the best plot of all the novels. 'Guy Mannering'—nearly always included in any list of the finest—is a drama depending upon reversal of fortune; and for this some tragedy is necessary. The story is splendidly worked out, and Meg Merrilies is the best portrayal in fiction of a figure from the Scottish underworld.

Most critics agree with John Buchan, that 'Old Mortality' "rises to scenes of tragic intensity which Scott never excelled, and contains figures of the most masterful vitality."

Most casual readers form a judgment of Scott from 'Ivanhoe'. This book has now for decades, both in England and in America, been made a schoolroom task. For its presentation of a historical period and personage, and for its truth generally to human nature, it is one of Scott's outstanding successes.

'Kenilworth' takes historical liberties, and contains anachronisms. But the author was aware of both. The book is nevertheless splendid pageantry and magnificent drama. Most of Scott's virtues as a writer are here found in conjunction. It is a fine example of the author's skill in selecting the essentials and avoiding the accidentals. The political events revolving around the court, with all their ramifications and impingements upon the lives of dozens of people, are exceedingly well handled and presented with dramatic skill. The portrayal of Queen Elizabeth is a masterful re-creation. Scott has so completely grasped the Queen's personality—her fickleness and colossal vanity—that almost every biography or play or story about Elizabeth that has since appeared is rather clearly stamped with the influence of Scott's drawing of the Virgin Queen.

He did a similar and almost as effective a delineation of Mary of Scotland in 'The Abbot'. If that characterization wavers occasionally, it is due to the fact, perhaps, that Scott, like most biographers of Mary, was in love with his heroine, and this may have thrown the portrait a bit out of focus.

At least two others of the novels rank high. 'Quentin Durward' gives a colorful and exciting portrayal of a young Scotsman fleeing from the feuds of his family to find adventure and fortune in France, and his encounters in the spider-web intrigues at the court and in the country of Louis XI. 'The Heart of Midlothian' is a thoroughly Scottish theme, beginning with the Porteous riots in Edinburgh. The events were near enough Scott's day to be known to him in part by word of mouth; the human nature he has to depict is that of his own people. One character, Jeanie Deans, dominates the tale; and there is no truer picture of a splendid woman, and no scene more moving in all fiction than that in which Jeanie pleads with Queen Caroline for the life of her sister Effie.

There are some temperaments that do not like history adulterated or heightened for dramatic purpose; and one might say that Scott is not for them, were it not that the interest of Scott's stories lies in the people —whether they are personages from historical records or people of Scott's imagination. Only Tolstoy compared with him in this power of bringing men and women from history into books, and treating them, not as symbolic puppets, but as creatures of flesh and blood. Scott never forgets that history is made by the clashes and conflicts of men and women.

Books By and About Scott

Among Scott's chief works are: 'Lay of the Last Minstrel' (1805); 'Ballads and Lyrical Pieces' (1806); 'Marmion' (1808); 'The Lady of the Lake' (1810); 'Waverley' (1814); 'Guy Mannering' (1815); 'The Antiquary', 'Black Dwarf', 'Old Mortality' (1816); 'Rob Roy' (1817); 'The Heart of Midlothian' (1818); 'The Bride of Lammermoor', 'Ivanhoe' (1819); 'The Monastery', 'The Abbot' (1820); 'Kenilworth', 'The Pirate' (1821); 'The Fortunes of Nigel' (1822); 'Peveril of the Peak', 'Quentin Durward' (1823); 'Redgauntlet' (1824); 'The Betrothed', 'The Talisman' (1825); 'Woodstock' (1826); 'The Fair Maid of Perth' (1828); 'Count Robert of Paris' (1832). Good biographies are John Buchan's 'Sir Walter Scott', E. J. Gray's 'Young Walter Scott', and J. G. Lockhart's 'Memoirs of the Life of Sir Walter Scott'.

SCOTT, General Winfield (1786–1866). "Old Fuss and Feathers" was the nickname the soldiers gave to Gen. Winfield Scott because he was such a lover of formalities. But in spite of this, Scott was for years the foremost soldier in the United States.

A Virginian by birth, Scott studied law at William and Mary College. But he practised this profession for only two years. In 1808 he became a captain in the army, and gained fame in the War of 1812 and in the Mexican War. By the end of that first war he had been made a major general because of his services in the battles of Chippewa and Lundy's Lane. In the second his victorious march from Vera Cruz to Mexico City made him a national hero. He was nominated for the presidency by the Whig party in 1852, but was defeated in the election. In 1852 the rank of lieutenant general was given him by Congress.

Scott performed many other important services. At the close of the Black Hawk War he negotiated the treaties with the Indians. He removed the Seminoles from Florida and Georgia. In the so-called Aroostook War, when the settlers of Maine and New Brunswick quarreled over the boundary line, he was sent to preserve peace; and in a similar controversy in the Northwest over the occupation of the island of San Juan in Puget Sound he performed a like service.

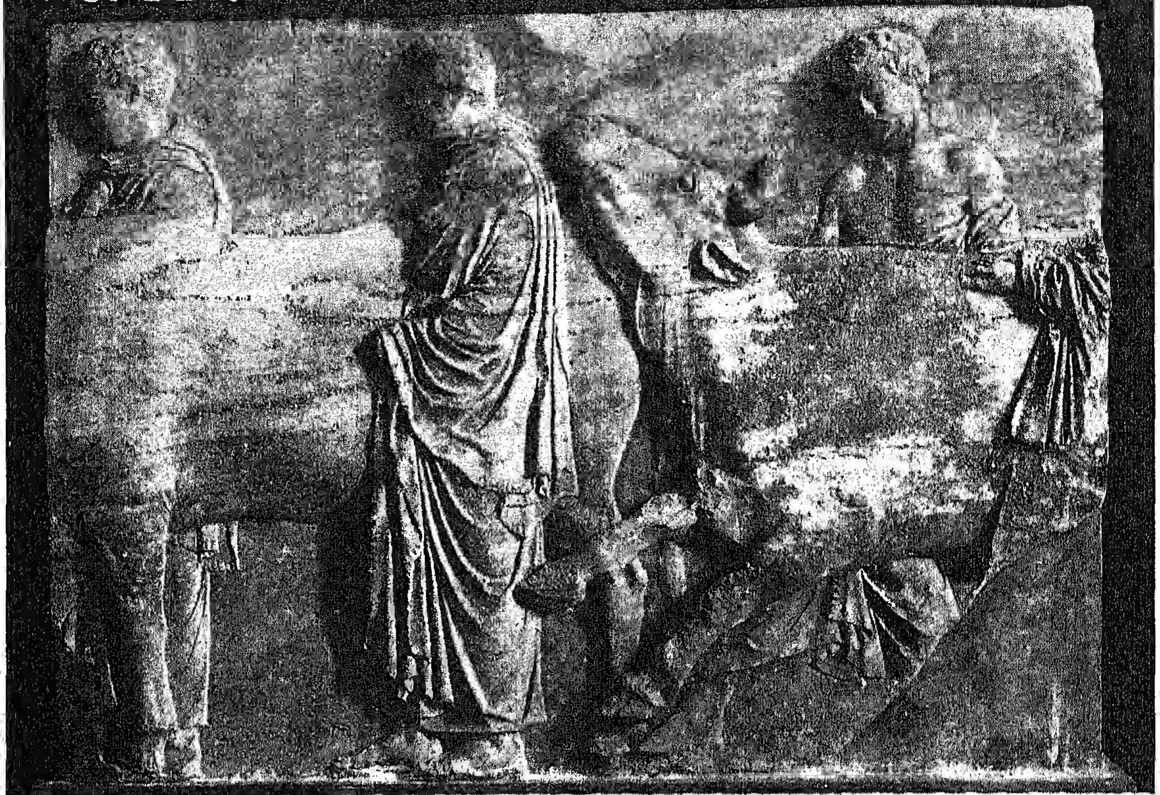
When the Civil War broke out Scott was general in chief of the army. But he was now 75 years old, and a younger man was needed to meet the situation; so after planning for the defense of Washington he laid down his command in 1861.

SCRANTON, Pa. The third largest city of Pennsylvania is Scranton, in the rugged northeast corner of the state. This is the heart of the world's richest anthracite coal region. Scranton's own coal deposits are being depleted. But the city's geographic situation still makes it the shipping center of a region that produces about 50 million tons of anthracite coal a year.

The city stands on both sides of the Lackawanna River, nearly enclosed by spurs of the Blue Ridge Mountains. But gaps in the ranges give east-west passage for railways. This advantage and a large supply of labor—provided by miners' families—have attracted industries, chiefly railroading, and the manufacture of mine machinery and textiles.

Coal breakers and mill stacks raise a jagged skyline against the hills. Within the city live many people of European stock, drawn by the mines. Scranton is the home of Marywood College for women, the University of Scranton for men (formerly St. Thomas College), and the International Correspondence Schools, largest in the world. In Nay Aug (Munsee Indian name for "roaring"), the principal park, are a miniature coal mine and the Everhart Museum. Scranton was settled in the mid-18th century, but its real growth dates from 1840, when George W. and Selden T. Scranton built a forge to make iron with anthracite fuel. It was incorporated as a city in 1866. Population (1940 census), 140,404.

WONDER WORKERS *in* MARBLE *and* BRONZE



A Procession of Sacrificial Cows from the North Frieze of the Parthenon

SCULPTURE. "How wonderful," exclaims Hawthorne, "to take a block of marble and convert it wholly into thought!" This is the miracle of the sculptor's art. As the painter speaks to us through line and color, so the sculptor reveals his message through beauty of form. He who has not learned to love sculpture and to read this message misses a whole world of beauty and truth. Primitive man, thousands of years before the Christian era, made wonderfully realistic statuettes of animals, which have been found in caves of southern France and northern Spain. Throughout the known history of the world, people have modeled clay, molded metal, and carved stone, marble, ivory, and wood.

Though the word sculpture (from the Latin *sculpere*, meaning "to carve") literally applies only to carved objects, it has come to include the entire art of representation in solid materials, even though the method may be modeling or molding.

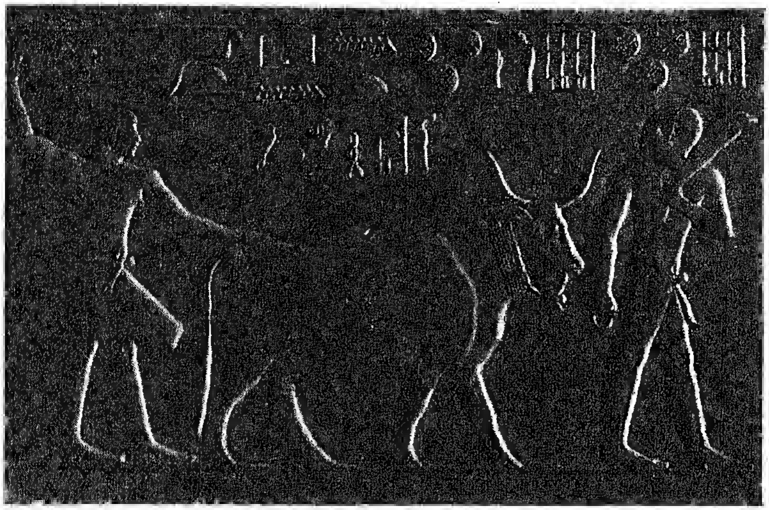
Sculpture is variously classified. *Decorative sculpture* is a detail of a larger unit, usually architecture. *Free sculpture* is intended to be viewed by itself. The ancient Greeks and Romans produced much free sculpture. It almost disappeared in the Middle Ages, returned with the Renaissance, and is popular today. Both free and decorative sculpture may be in the "full round" or in relief. The former shows the entire object or figure detached from its background. The latter attaches figure to background. If the figures stand out but little the sculpture is said to be in low relief, or *basso-rilievo;* if they are moderately raised, the sculpture is in middle relief, or *mezzo-rilievo;* if they stand well out, with perhaps here and there a figure completely detached from the background, the sculpture is in high relief, or *alto-rilievo.* Extremely low relief, in which slightly raised surfaces and depressed outlines vanish into the background, is called "squashed relief." Donatello was one who made the most of its possibilities for delicacy and close resemblance to fine drawing. "Intaglio" is the reverse of relief; that is, the design goes below the surface rather than above. Gems, seals, dies for coins, glass, and crystal are cut in intaglio.

In historical times, sculpture began in Egypt and Mesopotamia about 3500 B.C. Artistically, Egyptian sculpture is the more important. Most of it represents sphinxes, lions with human heads, and colossal portrait statues of the pharaohs. Their stiff, hieratic poses, their impersonal faces, express an aloof superhuman grandeur proper to rulers believed to be gods. Wrought in grim basalt or granite, they appear to be clothed with eternity. This is just what the Egyptian

artists intended. It is a shallow modern judgment to call those faces lifeless which were carved to imply a life beyond human. Egyptian ability to produce realistic effects is proved by the famous wooden statue of the so-called 'Village Chief' (for picture *see* Wood-Working and Wood-Carving).

Around the walls of Egyptian tombs ran bands of sculpture in low relief, showing scenes of daily life. Although artistic convention made the principal figures loom larger than the rest, turned heads in profile with eyes in front view, or placed shoulders in front view with legs in profile, these carvings are highly realistic. (*See* Egypt.)

ANIMAL SCULPTURE IN ANCIENT EGYPT AND ROME



Egyptians, Greeks, and Romans frequently represented in art the sacrificial cattle which were of great importance in their daily lives. The Greek bas-relief on the preceding page has a fine movement and rhythm in its procession. That above, from the tomb of Ptah-Hotep at Sakkara, shows the typical Egyptian stiffness and simplification. Roman realism and detail dominates the relief below, now in the Louvre.

While Egyptian sculpture was chiefly religious, the Babylonians and Assyrians of ancient Mesopotamia chose worldly themes. These sculptors seldom portrayed women, and their men were swathed in heavy draperies. Fabulous monsters, with the body of a bull or a lion, the wings of an eagle, and the head of a man, carved in high relief, stood as vast guardians beside palace gates. The Mesopotamians also carved real animals with intense naturalism in low relief. Notable, too, are the exquisite figures and reliefs carved or modeled by the ancient inhabitants of Crete, whose wonderful attainments have in recent years been revealed to us (*see* Aegean Civilization).

From the art of these far-off centuries came Greek sculpture. At first it was stiff, awkward, and conventional, but by the end of the 7th century B.C. it began to become realistic. In the 5th and 4th centuries it reached a height never since surpassed. The Greeks used as models their athletes, whom they adored almost as gods; for to them, the gods were but mortals become perfect in beauty and strength. Athletics and religion joined hands in the sculptural ideal of a perfect humanity. Women as well as men, Athena as often as Apollo, were cut in the white stone. As a rule Greek statuary was painted or gilded. It is hard for us not to think of a painted statue as tawdry, because, since 1600 A.D., only inferior work has been thus colored. But the Greek sculptors and those of the Middle Ages used color, and bronze was usually gilded.

The greatness of the Greek ideal pervades the famous Hermes of Praxiteles—probably the sole original of a first-rate Greek sculptor to come down to us—and the Venus de Milo, probably the most admired single statue in existence. We know the statues of ancient Greece in copies only. Many a fine marble was burned for lime, many a bronze melted for the metal.

All moods of life were caught in these Greek masterpieces. Venus and Zeus stand in superhuman calm. Myron's Discus-Thrower gathers all his strength for the act of hurling. The Victory of Samothrace, on the prow of her ship, in her blown and clinging draperies, is the embodiment of motion. The Victory by Paeonius, a lesser sculptor of the 5th century, is hardly less convincing.

Laocoön and his sons fight for their lives against serpents. Condemned by some as a mere exhibition of technical skill in anatomy, the 'Laocoön' group is nevertheless alive with an agony of body and mind.

Most renowned of all Greek sculpture is that which decorates the Parthenon. These marbles, both in the round and in relief, are attributed to Phidias, but no one man could have done them all. Phidias was to

the 5th century what Michelangelo was to the Renaissance. The vast sculptural compositions of the Parthenon, with their subject of gods humanized and man made superman, forming noble patterns of light and shade, mass and line, have had for centuries an irresistible fascination for each new generation.

Roman sculpture came from the Greek. Greek statues and Greek sculptors were transplanted to Rome. Although Roman sculpture was the last stage, and not the best stage, of Greek, it is not merely poor Greek. It set itself a task with which Greece was never concerned, that of portraying the Roman dream of world empire. From this ambition came two classes of purely Roman sculpture, the vivid portrait busts and statues of military leaders, such as that of Augustus Caesar, and the historic reliefs celebrating military triumphs, such as appear on Trajan's Column. (*See* Greek and Roman Art.)

With the rise of Christianity and the fall of Rome sculpture rapidly declined in technique and conception. From Constantinople, Egypt, Syria, and Asia Minor came the oriental influence for fine design and against exact representation. From the 7th to the 11th century, sculpture in Europe waned, with the notable exception of the bronzes of Germany.

However, it is a historical fallacy to suppose that the art influence of Rome ended abruptly in the year 476, or in any other year. Splendid Roman buildings and art works stood before the eyes of everyone in the Italian peninsula for centuries, although lack of technical skill and erudity of spirit prevented their effective imitation. In the rich, formal art of Byzantium, Roman arch and Grecian capital remained beside the work of the Orient (*see* Byzantine Empire).

PORTRAIT OF A ROMAN LADY

This famous portrait bust by an ancient Roman sculptor was long called 'Clytie'. Later it was identified as Antonia, daughter of Mark Antony.

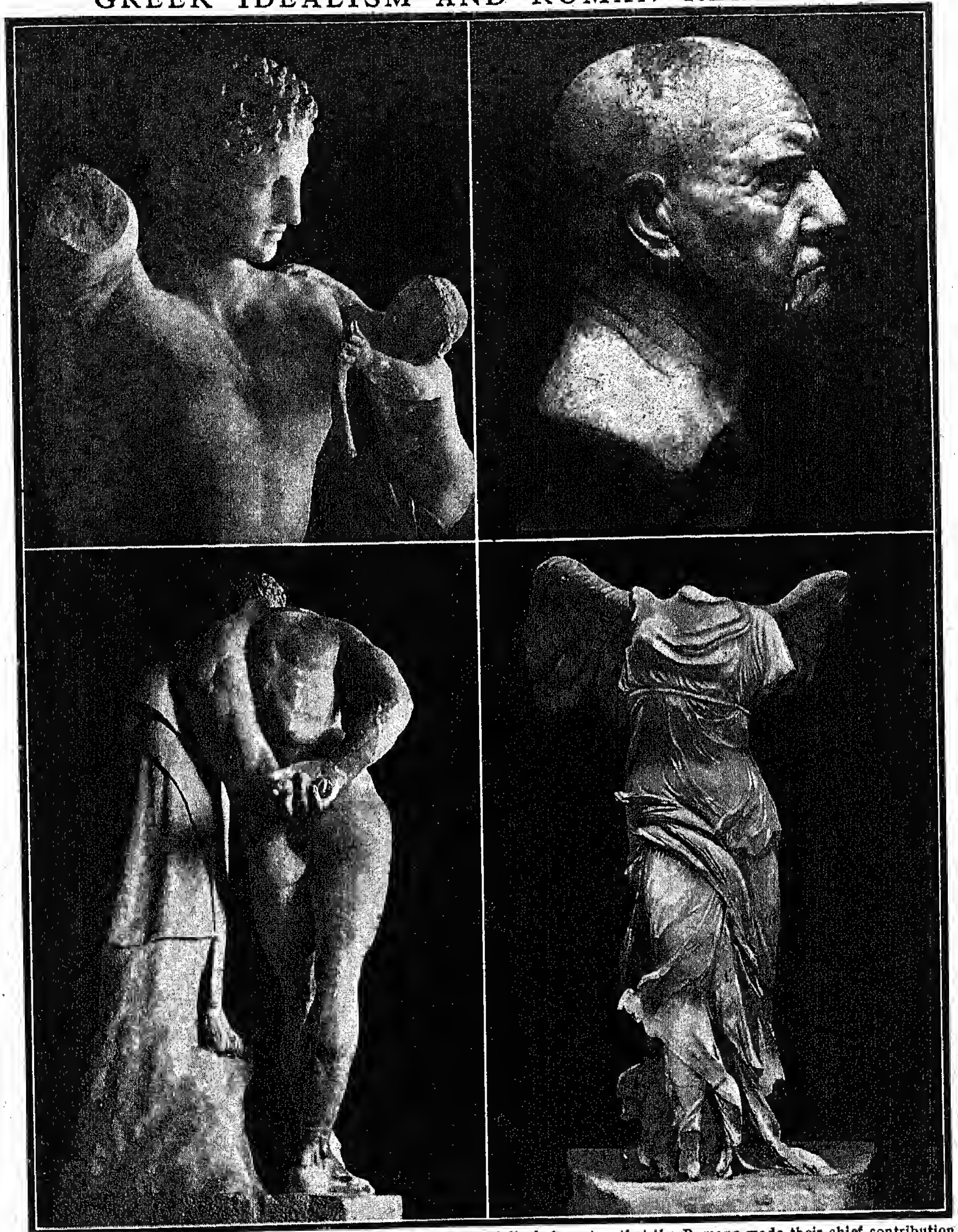
From pagan Rome, Christian Byzantium, and a crude but vigorous art impulse in the barbarian conquerors, came the style of art called Romanesque. It endured from the fall of Rome to about 1200, although its period of greatest distinction lay between 1000 and 1200. An element of the grotesque, and a childlike imaginative power—the contribution of Goth and Teuton and Celt—mark the medieval figures clustered under round arches of Romanesque buildings. The crudely but boldly executed faces of men of a new-made world peep from between the graceful leaves of a Corinthian capital on many a church of this period. Sculpture of the Middle Ages, whether of the Romanesque or of the later Gothic period, was almost entirely architectural, and can only be considered in conjunction with architecture of the period. (*See* Architecture.)

As the Gothic style in art developed, roughly between 1200 and the Renaissance in 1400, sculpture followed that amazing inspired architecture with its pointed arches, sweeping vaults and pillars, and upward-reaching spires. Tall, slim saints, their figures unnaturally straight, stiff, and elongated, adorn Gothic pillars and niches. We see them in the cathedral of Chartres, which illustrates the transition from Romanesque to Gothic. Those sculptural folds of the robes, unnatural when viewed as draperies, are wholly right when viewed as vertical decorations of the columns.

AN ASSYRIAN KING GOES HUNTING

A bas-relief of great strength and energy is that of Assurnasirpal hunting lions, 9th century B.C. which once ornamented the Calah (Nimrud) Palace when Assyria was great. It is now in the British Museum.

Not many years later, in the middle of the 13th century, we find fully developed Gothic in the west portal of the Amiens Cathedral, and also in the Reims Cathedral. The so-called 'Beau-Dieu' of Amiens, the 'Laughing Angel' of Reims, are the acme of natural grace and noble feeling. Yet they remain



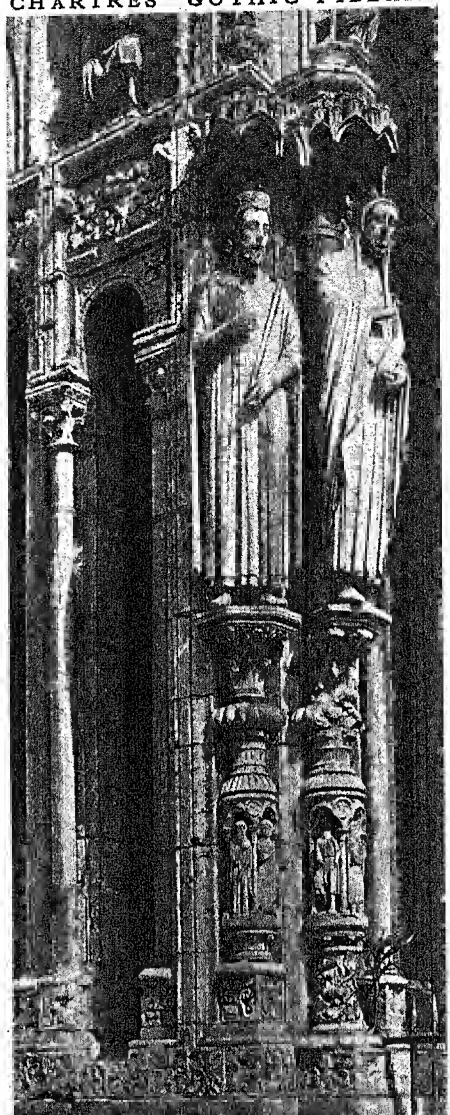
The sole piece of free sculpture known to have been carved by a great Greek sculptor and preserved to our day is the 'Hermes with the Infant Dionysus' by Praxiteles, now in the Olympia Museum. All other free sculpture known as Greek has come down to us only in copies. Contrast the idealized face of Hermes, upper left, with the purposeful head of the Roman citizen, republican period, now in the Metropolitan Museum of Art. It was in such portraits, full of character, that the Romans made their chief contribution to art. The Farnese Hercules, lower left, a copy after Lysippus, in the National Museum at Naples, is of the late Hellenistic period, when the lofty standards of the 5th century B.C. had given way, in Greece, to greater expressiveness and less idealism. The Victory of Samothrace, lower right, in the Louvre, has charmed generations by her noble poise and flying draperies.

appropriately architectural, a wonderful but small part of the vast, splendid cathedrals they adorn.

Throughout the medieval era, religion was the impelling motive in all art. Sacred writ, legend, and symbolism were its subjects, couched in terms of daily life, nobility, peasantry, trades, amusements, beasts, and plants. Around it all, the artists threw a marvelous atmosphere of fantasy, thanks to the influence of oriental ideas of intricacy and richness of pattern, and thanks to the half knowledge, half superstition of a vigorous-minded era emerging from semi-barbarism. Through the medieval centuries the wondrous story unrolled, told at first with the faltering technique but the intense imagination of children, and continuing to the last, when imagination failed and technique became an end in itself.

Single portals, and the entire fronts of vast cathedrals, capitals, and every architectural member, inside and out, were the sculptor's province. The story of mankind, on earth and after death, his present concerns, his future hopes and fears, the history of the world from Genesis to Revelation, were displayed in carving too beautiful or interesting not to be loved for its own sake, and too vivid to allow its lessons to pass unheeded, making up stone volumes wherein an illiterate age could read the stories it could not read in books.

CHARTRES' GOTHIC PILLARS



Slim saints in stiffly draped robes conform to architectural design on the Gothic pillars of the Chartres Cathedral. The two shown above appear in the north porch.

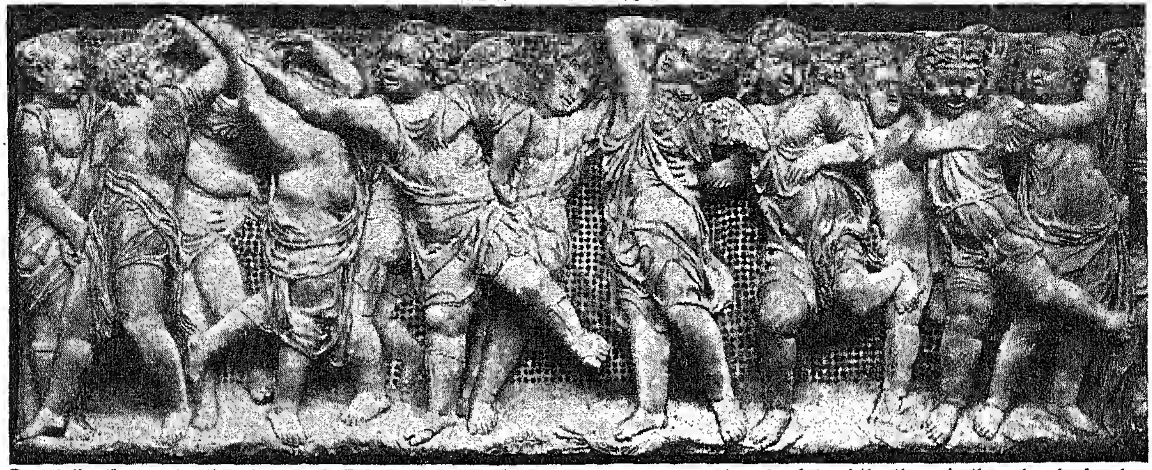
The Gothic style reached its height in France, and spread also to Germany, England, and Spain. It touched Italy much more lightly. The so-called "Italian Gothic" we feel to be scarcely Gothic in comparison with the work of the north. In Italy the classic tradition never wholly disappeared, and that fact paved the way for the Renaissance. (*See* Renaissance.)

During the Middle Ages, life on earth was held to be merely a preparation for the life to come. During those centuries, wars, pestilence, ignorance, and all their train of cruelty and fear naturally supported the belief that little was to be hoped of life on earth. (*See* Middle Ages.) By the year 1400 political and social conditions had improved, science had made a beginning, comfort and elegance and culture existed. Further gains were made in the next two centuries. Such improved conditions prepared the mind for acceptance of the Greek ideal, reflected in Greek art, that man should live to the height of his powers, and seek the fullest development of body and mind.

To be sure, the Italians of the Renaissance did not fancy that they were returning to Greek ideals, but to Roman. People did not know for many centuries that Rome owed almost everything in art to Greece. So Roman arches, Greek pillars, noble and realistic human figures, returned to grace architecture and sculpture. Actual copying of classic models occurred until the new style had found itself. Saints and biblical characters no longer came from the sculptor's hands sad, stiff, and thin, but somewhat in the old guise of Jove, Poseidon, and Apollo; and Aphrodite smiled again from many a Madonna's eyes. The Renaissance also made use of Greek details, in the same way as the Romans used them, as pure decoration, without understanding Greek principles, or Greek power, reserve, and solidity. But Renaissance art had at the core a nervousness, an exuberance, a love of display and of narrative, a tendency to make bas-relief do the work of painting, which was as far removed from Roman grandeur as from Greek calm.

The change from Gothic to Renaissance art was more abrupt in the northern countries than in Italy, and it also arrived later. The revived classic art which burst upon north Europe about 1400, had long been brewing in Italy. It did not reach painting, sculpture, architecture, and literature at exactly the same time in any country, nor did it reach all countries at the same time. Perhaps the first sign of it is found, in Italian sculpture, in the remarkable pulpit in the Baptistery of Pisa, completed in 1259 by Niccolo Pisano (Nicholas of Pisa). Its Gothicism was mixed with classic feeling, and some of its figures were actually copied from Roman models. We see the stirrings of the Renaissance also in the bronze doors of the Baptistery in Florence made over 50 years later by Andrea Pisano

DONATELLO'S DANCING CHILDREN OF THE EARLY RENAISSANCE



Donatello, the great artist of the early Renaissance in Italy, embodied all the new-found gaiety of the times in these lovely dancing children carved for the singing gallery of the cathedral of Santa Maria del Fiore, better known as the Duomo, in Florence. The work was removod from its place, and is now preserved in the museum back of the cathedral.

(Andrew of Pisa), pupil of Niccolo's son, Giovanni. The bas-reliefs of Andrea's doors show the influence of Giotto in their quietly gentle grace and strength. Emotionalism was the outstanding characteristic of Giovanni Pisano whose best work is seen in his pulpit for the cathedral of Pisa. The dramatically distorted figures seem to express his own tragic outlook on life.

The true "father of Renaissance art," however, was Donatello (1386?–1466). A realist, an innovator, and a genius, he responded keenly to classic art. He freed the body of its formal medieval drapery, and in his 'David' produced the first nude since classical days. He made the first great equestrian statue of modern times, the bronze monument of Gattamelata, military leader of Padua.

At the same time, Lorenzo Ghiberti reintroduced perspective and landscape into bas-relief in the magnificent bronze doors which Michelangelo pronounced fit for the gates of Paradise (*see* Ghiberti, Lorenzo).

Less venturesome than Ghiberti, less dramatic than Donatello, was Luca della Robbia, in whose Madonnas and children are mirrored the more smiling aspects of life. His panel for the singing gallery of the cathedral of Florence is a thing of joy.

DELLA ROBBIA'S SINGING BOYS

Also designed for the singing gallery in the cathedral of Florence are these lyric "singing boys" by Luca della Robbia, one of whom taps time with his foot. They are now in the museum of the cathedral.

The children, praising God in music, are happy, robust Tuscan children of the day. His nephew, Andrea della Robbia, carried on his traditions. His 'Madonna of the Architects' is a wistful, almost melancholy Madonna, and the Child in this group is especially lifelike, as he snuggles up to his mother, and sucks on one of his pudgy fingers.

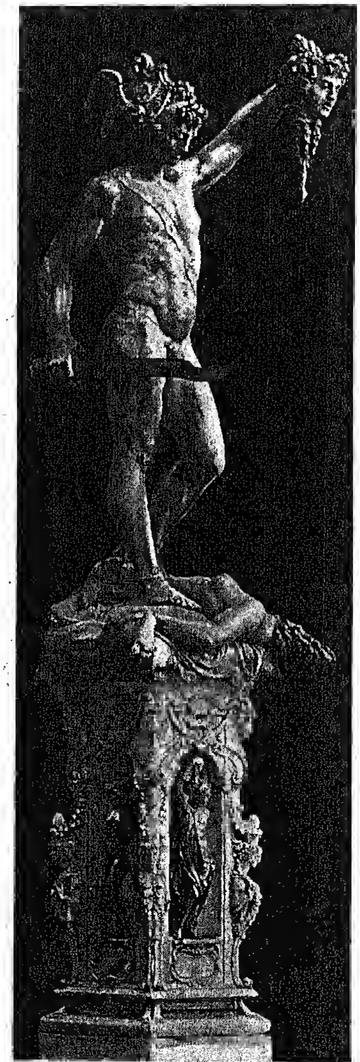
Orcagna is chiefly famous for his tabernacle for the Madonna of Or San Michele, Florence, the base of which is decorated with reliefs of the life of the Virgin. Desiderio da Settignano introduced "putti" (children) whenever possible. His groups representing the Virgin and Child were so popular that a great many copies of them were made and sold. Desiderio caught the spirit of his master, Donatello, and added to it a charm of his own. Mino da Fiesole executed many altars, tombs, reliefs, and busts, his masterpiece being the tomb of Bishop Leonardo Salutati in the cathedral of Fiesole. The St. Sebastian in the Collegiate Church at Empali, done by Antonio Rossellino, is regarded as one of the most graceful sculptures of the early Renaissance. Giovanni Antonio Amadeo was essentially a humorist and a portrayer of the charms of childhood. His children are always lively and imaginative.

Andrea del Verrocchio has left us in his equestrian statue of Colleoni in Venice the finest monument of its kind in the world. In the vigorous pose both of horse and rider is stored up all the energy of the Renaissance. Jacopo della Quercia produced reliefs that showed the influence of Donatello and which foreshadowed Michelangelo.

Benvenuto Cellini, who was essentially a goldsmith, is at his best in his small figures. His famous bronze Perseus, however, has all the grace and spirit of youth.

Greatest name of all was that of Michelangelo (1475–1564), who "stood on the shoulders of Verrocchio and Donatello," and produced the most distinguished painting and sculpture of modern times. This harsh, lonely man felt all about him the money-making meanness, the decadence, which was to bring the swift downfall of Italy. Passionate faces, twisted figures, wrathful or agonized poses, reflect the mood of this saddened patriot. The "furiousness" of Michelangelo is dominated in his own work by his flawless skill and strength of character. But, imitated by lesser men, it brought to an end the true Renaissance period, though Renaissance influence has not ended even in our own day.

CELLINI'S 'PERSEUS'



Benvenuto Cellini, roistering goldsmith of Florence, made this famous bronze of Perseus beheading Medusa, with its ornate Renaissance pedestal. The original is in the National Museum, Florence, and a splendid copy in the Loggia dei Lanzi. Cellini's own story of the modeling and casting of this famous work is a literary masterpiece in itself.

Giovanni da Bologna, or Giambologna, the last great sculptor of this period, is best known for his bronze 'Flying Mercury', which has been described as a miracle of movement. His colossal figures, however, were too elegant and effeminate for the heroic manner. The best of his many fountains is that of the central square of Bologna. In his allegorical nudes, Bologna started what is known as "exposition art." His 'Rape of the Sabines' and 'Hercules and Nessus', both in the Loggia dei Lanzi in Florence, represent his classical style at its best.

Early French Sculpture

In France, Michel Colombe (1430?–1512?) was the outstanding sculptor of the 15th century. His reliefs for the tomb of Francis II of Brittany, now in the cathedral of Nantes, and his 'St. George and the Dragon' in the Louvre maintain a fine balance between idealism and realism.

Jean Goujon, 16th-century French master, expressed himself in sinuous draped forms. His 'Fountain of the Nymphs' belongs to the world's greatest sculpture, and has been pronounced the best example of classic art since the days of Greece. Germain Pilon, another French sculptor of that period, is represented by his kneeling bronze of Chancellor de Birague and his ornamental urn containing the heart of Henry II, both in the Louvre.

In Germany, in the 15th century, Nuremberg was the center of art. Veit Stoss (1440?–1553), a master wood-carver, was at his best in emotionally realistic crucifixes. He was active for many years in Cracow, Poland, where his 'Death and Assumption of the Virgin' in St. Mary's Church remains as evidence of his Gothic genius. Adam Krafft (1455?–1509), another exponent of Gothic sculpture, worked in stone. His masterpiece, 'The Seven Stages of the Cross', in which he obtains a monumental effect by the use of fewer figures and simple draperies, is now, with the exception of one group, in the Germanic Museum, Nuremberg. Peter Vischer, foremost of the German bronze casters of that period, has left as his best work a bronze tomb of St. Sebaldus in a church at Nuremberg.

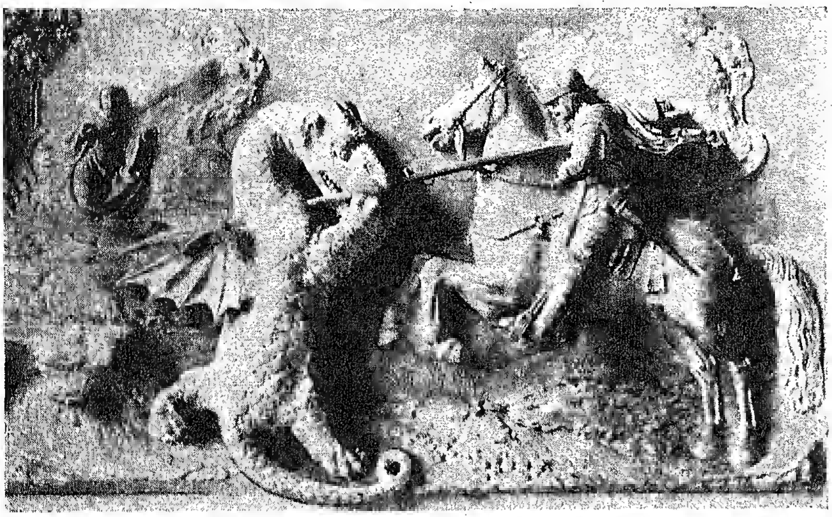
In Antwerp, François Duquesnoy (1594–1644) was known as "the Rubens of Flemish sculpture," and exerted a wide influence. Nicholas Stone, who was associated with the architect, Inigo Jones, was the leading British sculptor of that time.

The Theatrical Baroque

The century and a half after Michelangelo presents a sorry spectacle in its expression of the colossal, the elegant, and the violent. This field was led by Giovanni Lorenzo Bernini (1598–1680), a man of great technical skill but spiritual poverty, who ushered in the baroque era. His 'St. Theresa' is typical, in its ecstatic realism, dramatic postures, tortured draperies, clouds, sunburst, and lightning. The baroque style was theatrical, and sought to exhaust a subject rather than to leave anything to the imagination. It was sentimental and tricky, indulging in feats of craftsmanship devoid of meaning.

Bernini had many followers, among them Giovanni Battista Foggini, Pietro Baratta, and Alessandro Algardi. Algardi became the favorite of Innocent X, of whom he made a notable bronze statue. His best known work is his altarpiece of St. Leo and Attila, for the Cappella Leonini, St. Peter's, a dramatic painting in marble.

ST. GEORGE SLAYS THE DRAGON



An early figure of the French Renaissance was Michel Colombe, who is noted chiefly for his tomb of Francis II of Brittany, in the Nantes Cathedral, and for this high relief of St. George and the Dragon, in the Louvre.

Prominent among the 17th-century native German masters were Johann Mauritz Gröninger and his son Johann Wilhelm, Andreas Schulter, and Balthaser Permoser. Schulter's Teutonism is shown in the herculean strength of his figures, especially in his bronze equestrian statue of Frederick I of Prussia, one of the landmarks of Berlin. Some of Permoser's best work decorates the palace of the Zwinger in Dresden.

The first baroque sculptor of France was Pierre Puget (1620-1694), whose Milo of Croton and 'Perseus Delivering Andromeda' in the Louvre reflect the fire of his southern temperament.

The leader of the baroque movement in Berlin at the beginning of the 17th century was Lorenz Hörnigk, who designed the altars for the *Stadtkirche* at Pirna. Jörg Zürn, a sculptor in wood, left mortuary pieces elaborately carved with reliefs, statuettes, and ornaments. Baroque theatricalism is seen in the monument of Heidenreich von Lethmate in the cathedral of Münster, by Gerard Gröninger. Toward the close of the century, Elias Nicolai was carving effigies which show convincing but heavy realism.

That patron of art, Frederick the Great, attracted many brilliant foreign artists to Berlin, among them Jan Pieter Anton Tassaert, a Belgian who had been schooled in France; Pieter Anton Verschaffelt, a product of Italian training; and Lorenzo Matielli, an Italian, who is remembered by four groups showing the labors of Hercules, which stands at the entrance to the Reichskanzlei-Palast, Vienna.

Artistic taste in the days of the baroque movement, with its exaggerated emotionalism, was at a low ebb. Critics condemned the Gothic as the work of barbarians, and felt as great scorn for the ancient Greeks. Strange as it may seem, people did not know, until about 1760, that the much admired and copied art of ancient Rome was itself but a copy or a misapprehension of Greek art.

This important news was brought to European attention by Johann Winckelmann, who came to be the leading art critic of Europe. He made careful researches into antiquity, and set in proper rank the works of Phidias and his contemporaries, of the Romans who copied the great Greeks, and of the later Greek sculptors in the period of decadence.

A reaction set in, against baroque, against the Renaissance, and in favor of ancient Greek art. This reaction is known as the Second Renaissance, the

A MASTERPIECE OF GOUJON, GREATEST SCULPTOR OF THE FRENCH RENAISSANCE

Something of classic ease and grace is revived in the sculpture of Jean Goujon, the first great sculptor of the French Renaissance. Above is a part of the 'Fountain of the Nymphs', or 'Fountain of the Innocents', now in the Louvre.

THE BAROQUE IN SCULPTURE

Sculpture attempted to do what is best left to the theater when it turned to the baroque style. Its exaggerations are apparent in Bernini's 'St. Theresa', in the church of Santa Maria della Vittoria, Rome.

Greek Revival, or the Philhellenic movement. The leading sculptor of this period was the cold and accurate Antonio Canova (1757–1822), to whom is often credited the rediscovery of Greek genius which properly belongs to Winckelmann. Other sculptors of the period were the equally cold and emotionless Bertel Thorvaldsen of Denmark, John Flaxman of England, and Johann Heinrich Dannecker of Germany. Their work, refreshing as it was after the tawdry baroque, remained lifeless, since they worked from looking at statues and not at real life.

Dannecker is of especial interest to Americans. In 1863, Longfellow visited his school in Stuttgart and described it later in 'Hyperion'. The influence of Canova is seen in Dannecker's 'Four Seasons' at the palace at Stuttgart, and in his 'Sappho' in the art museum of his native city. Flaxman is remembered for the delicate reliefs he designed for the Wedgwood pottery.

Although the Renaissance had fallen short of Greek power and solidity, it had nevertheless acquired tremendous vitality by using living models and working from nature just as the Greeks had done. The Greek Revival was weak in modeling, oversweet in expression, waxy and super-refined in finish. Over it lay the paralysis of imitation.

The effect of the Greek Revival lay long upon sculpture, even after architecture had long freed itself by means of the renewed interest in Gothic. Sculpture renewed its strength at last, not by contact with Gothic, but by a return to study of the Renaissance and to the method of using the past as a teacher and a source but not as a fixed and cramping system to be followed slavishly and without change.

The beginning of the 18th century in France found the plastic art in one of its lighter moods. Jean Baptiste Lemoyne, most of whose works were destroyed in the French Revolution, heads a long list of brilliant sculptors. Edmé Bouchardon, remembered by his 'Cupid with Bow' in the Louvre, was called by Voltaire the French Phidias. A master of graceful form was Jean Baptiste Pigalle (1714–1785). Breathing with life is his 'Mercury Attaching Wings to His Feet'. The exquisite 'Bathing Girl' in the Louvre by Étienne Maurice Falconet, Pigalle's rival, well represents the spirit of the times. Louis Michel Claude (Clodion), in his nymphs, satyrs, bacchantes, and nereids, exhibits the same daintiness and playfulness. Antoine Denis Chaudet and François Joseph Bosio, French sculptors of the late 18th and early 19th centuries, also excelled in graceful subjects.

Although Jean Antoine Houdon (1741–1828) worked in the period which deserted the baroque for the Greek, he nevertheless had the courage to employ the dress of the day, and not classic robes, in his famous statue of George Washington in the capitol at Richmond, Va. A similar defiant spirit was François Rude, who is sometimes called the first truly modern sculptor. His masterpiece, 'The Departure of the Volunteers', done for the Arc de Triomphe, is said to be national enough to be called 'The Marseillaise'.

Among the 19th-century sculptors in France are many entitled to high rank. Antoine Louis Barye is best known for his animals in action; such subjects as a tiger devouring a gavial, a lion crushing a serpent, a jaguar devouring a hare. Henri Chapu is remembered

JOAN OF ARC SEES VISIONS

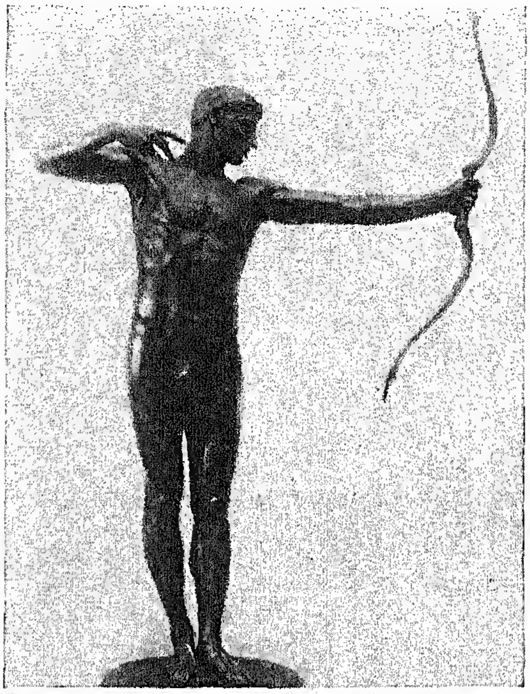
This figure of Joan of Arc, in the Luxembourg Museum, Paris, reflects the Greek spirit of the work of Henri Chapu.

for his 'Mercury Inventing the Caduceus' and the kneeling figure of Joan of Arc in the Luxembourg Museum. Jean Baptiste Carpeaux shows emotional and dramatic power in his relief of the Dance in the New Opera House, Paris, and his 'Four Quarters of the Earth Supporting the World' in the Luxembourg Gardens. Jules Dalou did a fine relief of Mirabeau delivering his address before the Marquis de Dreux Brézé.

Gustav Bläser may be classed as the outstanding German sculptor of the modern era. Like Barye, August Kiss specialized in animals. Ernst Friedrich August Rietschel has to his credit a monument of King Friedrich August in the Zwinger at Dresden. Ernst Hähnel, author of the Bacchus frieze in the Dresden Theater, represents the transition from the classic period to the romantic.

In Italy, at the beginning of the modern era, Lorenzo Bartolini represents a return to classic simplicity in his group, 'Pyrrhus Throwing Astyanax from the Walls of Troy'. Luigi Pampaloni excelled in statues of children.

A MODERN WORK IN CLASSIC STYLE



Teucer, the famed archer of Greek mythology, half-brother of Ajax, draws a sweeping bow in this bronze by Sir William Hamo Thornycroft, now in the Tate Gallery, London. Thornycroft, in several works, followed classic tradition.

Most important of the neoclassicists in Germany was Johann Gottfried Schadow. Highly individual, and independent of any movement, Schadow left as his masterpiece a standing portrait group of the princesses Louise and Friederike of Prussia, in which girlish charm is idealized. Johann Peter Alexander Wagner is best represented by his groups of children in the palace gardens at Würzburg. Daniel Christian Rauch, Germany's greatest historical sculptor, executed heroic statues of the national military leaders.

Thoroughly national is the colossal figure of Germania at Niederwald, by Johannes Schilling, pupil and follower of Hähnel. Reinhold Begas, prominent in the latter half of the 19th century, made excellent portraits and genre studies. Adolph Hildebrand of Jena was another German sculptor who was essentially modern in feeling and treatment.

Progress of the Art in England

Sir Richard Westmacott, whose monuments of Pitt and Fox stand in Westminster Abbey, was the successor of Flaxman in England. The equestrian statue of George IV in Trafalgar Square, London, and the 'Duke of Wellington' in the Royal Exchange are the work of Sir Francis Legatt Chantrey, another British master of the early 19th century. Alfred Stevens carved the Wellington monument in St. Paul's Cathedral.

Of the classic school, Patrick McDowell and John Gibson were the leading representatives. It was Gibson who startled the art world by his tinted Venus, with her glowing ivory body, blue eyes, and golden hair. Other British sculptors of that period were William Theed, William Pitts, Thomas Campbell, Richard John Wyatt, and Joseph Durham. John Henry Foley is of interest to Americans because of his statue of General Jackson at Richmond, Va.

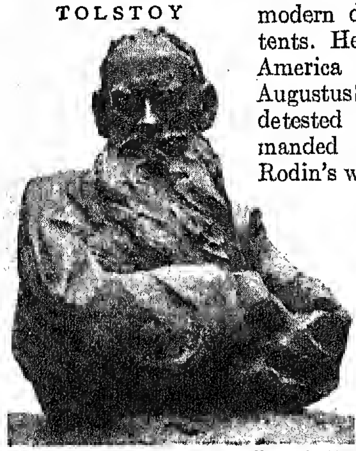
Thomas Woolner, whose early works, such as the 'Death of Boadicea' and 'Puck', reflect the spirit of romanticism, is remembered by his medallions of Tennyson, Carlyle, Wordsworth, Dickens, Macaulay, and Darwin.

Among the representatives of a later phase of British sculpture are Thomas Brock, George Frederick Watts, Sir Frederick Leighton, Sir William Hamo Thornycroft, E. Onslow Ford, Sir Alfred Gilbert, and John M. Swan. Leighton, like Watts, was likewise a painter, but his 'Sluggard', 'Needless Alarms', and other plastic works won him as much fame as his canvases. Thornycroft's genre studies, such as his 'Mower' and 'Sower', suggest the paintings of the Barbizon School (*see* Painting). Ford is remembered principally for his Shelley memorial at Oxford. Gilbert's 'Icarus', cast in 1884, was the first bronze to be cast by the *cire perdue* process in England. His more pretentious works include the Shaftesbury memorial fountain for Piccadilly Circus, London. Swan was a sculptor of animals. Sir George James Frampton did many public monuments and experimented successfully with the use of color in statuary. Eric Rowland Gill, a notable craftsman in stone and also in wood, reflects in many examples of his work a deeply religious point of view.

Rodin and His Influence

It was the great Frenchman, Auguste Rodin (1840–1917), who definitely broke with classic authority. In his 'Burghers of Calais' there is no hint of Greece or Rome. His gift to art was impressionism. He sought to convey emotions, not to produce illusion. His roughly modeled, half-finished figures are filled with

TOLSTOY



Paul Troubetskoy has followed the technique of Rodin in this bronze.

modern doubts and discontents. He opened the way in America for such men as Augustus Saint-Gaudens, who detested tricks and commanded a fine technique. Rodin's work, subjective and romantic, is the strongest influence in sculpture today.

Among the pupils, or followers, of Rodin who have continued the emotional and pictorial quality of his work are Medardo Rosso, an Italian resolved to combat the sugary quality of Italian sculpture; Paul Troubetskoy, Russian; George Grey Barnard, American; and Constantin Meunier, Belgian. Unlike as their work is, it is all rooted in Rodin's principles. These principles took no account of the noble form of the great periods of the past. To restore form without succumbing to formality, and to imply emotion without resorting to the pictorial, is the objective of certain modern sculptors, including the four noted French artists, Aristide Maillol, Charles Despiau, Joseph Bernard, and Antoine Bourdelle.

Other sculptors have gone still further than these men in adhering to abstract design and eliminating realism. Mass, with its inherent energy, supplants representation. Yet how varied is the result of the followers of this theory—Amadeo Modigliani, Constantin Brancusi, Alexander Archipenko, Henri Laurens, and others. Jacob Epstein in England tried out this theory of pure abstraction, then returned to an emotional style. Ivan Mestrovíc, the Yugoslav sculptor, followed no school, but evolved new forms on primitive lines.

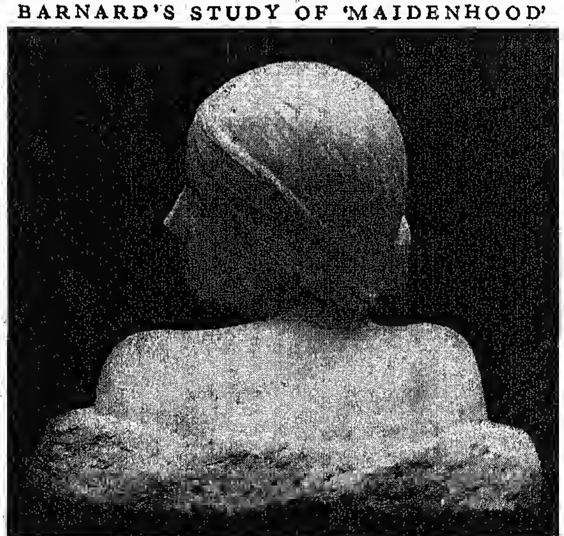
'THE AMERICAN SOLDIER'

A rugged type of modeling fits the character of Jacob Epstein's 'The American Soldier'.

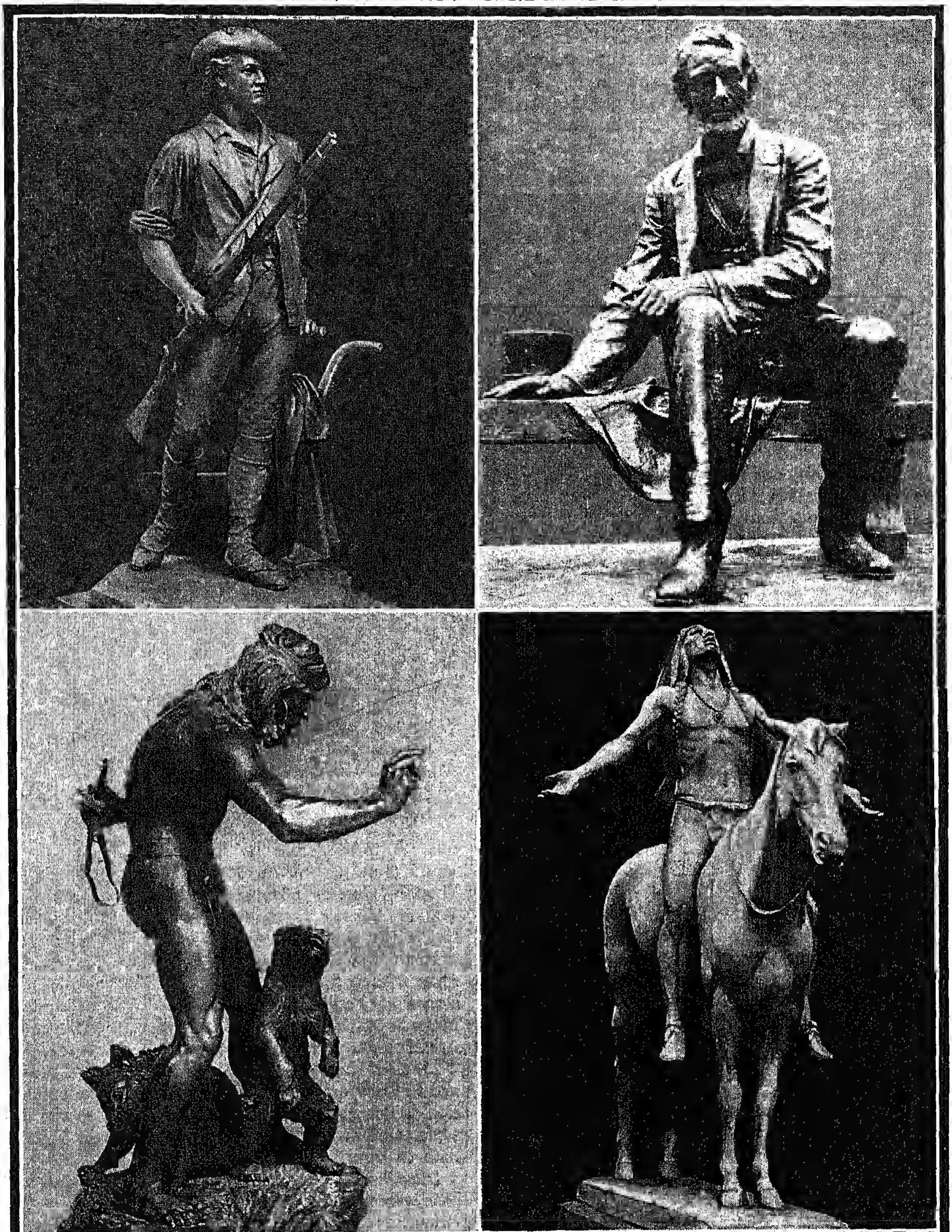
Chief Sculptors in the United States

SCULPTURE in the United States was at first chiefly influenced by European artists and ideals. In the late colonial period, Patience Wright modeled miniature busts in wax; but neither her work nor that of William Rush (1756–1833) and John Frazee (1790–1852) with portrait busts was important in creating a distinctive American spirit. Interest in the art was awakened by Jean Antoine Houdon, who sailed for the United States in 1785 to make models for his famous statue of Washington at the Virginia state capitol. The 'Greek Slave' of Hiram Powers (1805–1873) was the first work of sculpture in the United States to attract the attention of the world. Powers followed Canova in his imitation of classic art. His work is no longer considered of high merit but it did much to arouse a taste for sculpture in the New World. The sentimental classic spirit was likewise dominant in the work of Thomas Crawford and Horatio Greenough. Among other early sculptors were Thomas Ball, William Wetmore Story, and Harriet Hosmer. It was not long before American sculptors began to develop a vigorous originality. The true American spirit was expressed by Henry Kirke Brown (1814–1886) in his fine equestrian statue of Washington, and by his pupil John Quincy Adams Ward in his statues of Indians and negroes, as well as in his portraits of Horace Greeley and Henry Ward Beecher. The work of Erastus Dow Palmer, Olin L. Warner, and John Rogers is likewise characterized by the same spirit of independence. Augustus Saint-Gaudens rose to still greater heights in commemorating and interpreting great characters in American history. Frederick MacMonnies, his pupil, produced work of a very different order, full of lightness, grace, and buoyancy. Daniel Chester French is distinguished by the purity and ideal beauty of his work, shown in his well-known 'Death and the Sculptor', and in many fine portrait statues. Paul W. Bartlett is known by his impressive statues of

BARNARD'S STUDY OF 'MAIDENHOOD'



Smooth, flowing treatment of the hair, and great simplicity of manner produce the girlish charm of 'Maidenhood', by George Grey Barnard, a noted modern American sculptor.



'The Minute Man', at upper left, made by Daniel Chester French for the centenary of the battle of Concord in 1875, stands on the site of the battle, not far from the Old Manse where Hawthorne lived, in Concord, Mass. A rugged and awkward son of the prairies is the Lincoln of Gutzon Borglum, upper right, which is placed before the Courthouse in Newark, N. J. The roughly modeled great bronze figure well expresses the American conception of the heroic president. Humor and realism enliven 'The Bear Tamer', lower left, an early work of Paul Wayland Bartlett. Often treated as tragic, the Indian here is a happy savage, amusing himself with equally wild pets. The group is in the Metropolitan Museum of Art. Cyrus Edwin Dallin's 'Appeal to the Great Spirit', lower right, represents a more typical idealization of the Indian. It is in the Boston Museum of Fine Arts.

Michelangelo and Columbus in the Congressional Library. George Grey Barnard has sought to express, as in his 'Two Natures', the great underlying forces of human life. His realistically modern Lincoln has aroused much comment, favorable and unfavorable. William Ordway Partridge has used impressionistic methods in his series of busts of English poets.

The vanishing life of the American frontier, especially its Indians and wild animals, is depicted with truth and sympathy by Solon Borglum, one of the most original of American sculptors, as well as by Alexander Phimister Proctor and Edward Kemeys. Cyrus Edwin Dallin made a dramatic record of the Indian after the coming of the white pioneers in 'Signal of Peace', 'Appeal to the Great Spirit', and other well-known works. The Western pony of cowboy days is preserved in the dashing bronze of Frederic Remington.

Gutzon Borglum has also shown great vigor in his many ambitious works, which include two well-known portraits of Lincoln, a seated figure at Newark, N. J., and a colossal head in the rotunda of the Capitol at Washington, as well as his prodigious figures of great Americans cut in the solid rock of Mount Rushmore (*see* South Dakota). John J. Boyle expressed a strong native spirit, especially in the Indian group entitled 'The Stone Age'. Karl Bitter who planned the decorative sculpture for the great expositions at Buffalo, St. Louis, and San Francisco, produced a number of fine portrait statues. Charles Niehaus and Andrew O'Connor are among his most prominent successors. Lorado Taft has done much to beautify Chicago by his graceful ideal groups, and his influence as a writer and lecturer on sculpture has been very wide. His 'Spirit of the Great Lakes' in Grant Park is an exquisite piece of symbolism, and the sterner realities of life are depicted in his dramatic representations, 'The Blind' and 'Fountain of Time'.

Robert T. McKenzie in 'The Athlete', 'The Relay', and other similar studies, has made accurate records of physical qualities. Herbert Adams has achieved high distinction in his portrait busts of both men and women. Work of the first rank has been done by Albin Polasek, head of the sculpture division, Art Institute, Chicago, where his 'Sower' is displayed.

SAINT-GAUDENS' CONCEPTION OF VICTORY

A light-stepping Victory is part of the detail of the equestrian statue of General Sherman at the entrance of Central Park, New York, by Augustus Saint-Gaudens.

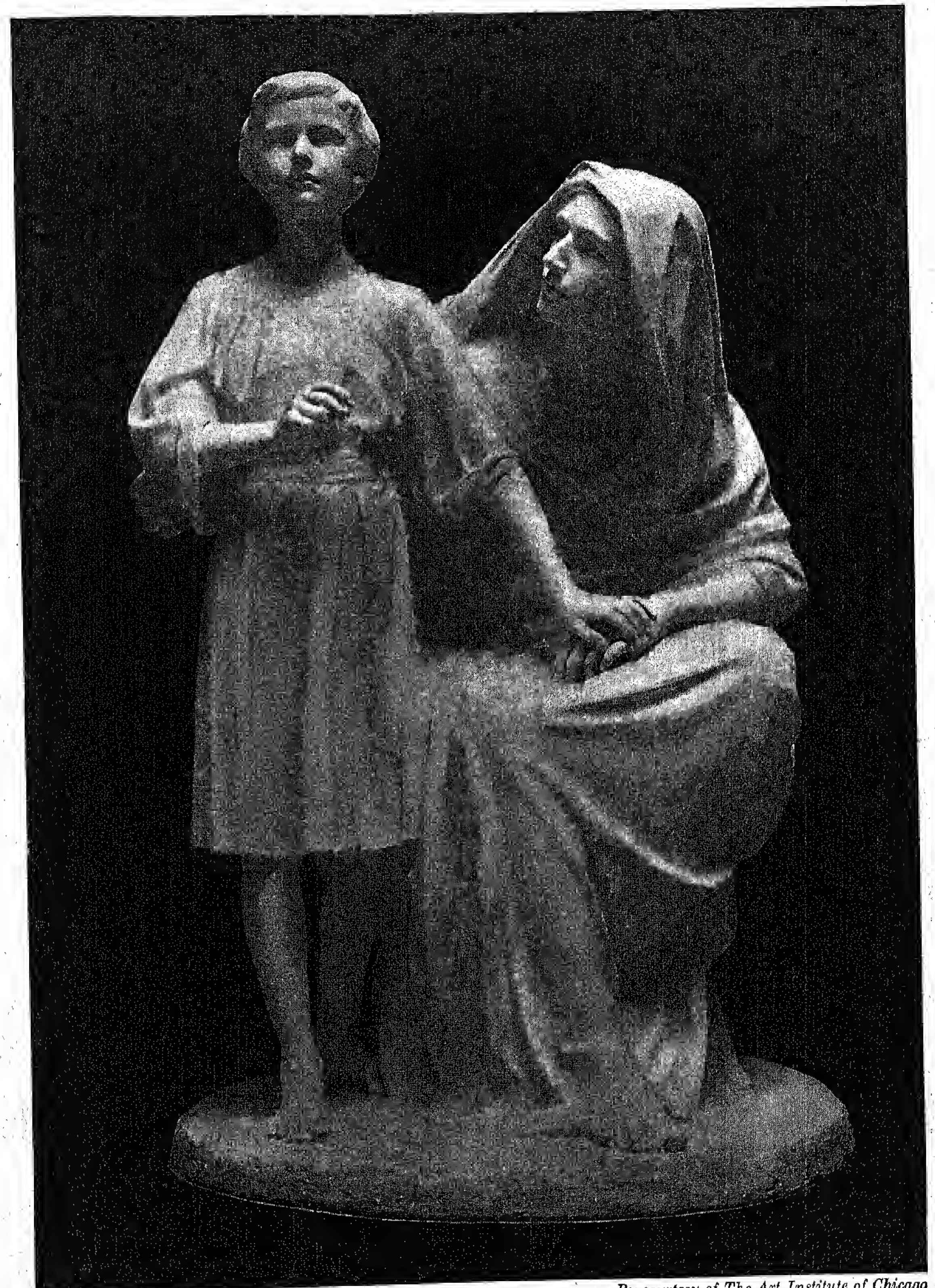
His widely known 'Fantasy' is in the Metropolitan Museum, New York City. Distinguished work has been done by Vinnie Ream Hoxie, Philip Martiny, Larkin G. Meade, and Randolph Rogers, who did the bronze doors for the Capitol at Washington. Isidore Konti has been highly successful in monumental decorative work, and H. Augustus Lukeman has done a number of notable symbolic groups. Leonard Crunelle brought to sculpture a remarkable gift for depicting faces and figures of youths, as have also Janet Scudder and Abastenia St. Leger Eberle. Jo Davidson achieved wide recognition for his many portrait busts of celebrities. Paul Manship brings a masterly technique to working out classic subjects, such as centaurs and dryads, in the most primitive Greek style.

Many others have contributed significantly to sculpture in the United States, among them Bela L. Pratt, Alexander Sterling Calder, Hermon MacNeil, R. I. Aitken, Mrs. Gail Sherman Corbett, Samuel and Henry H. Kitson, Charles Grafly, Frank Duveneck, Richard E. Brooks, Rudulph Evans, Malvina Hoffman, Gertrude Vanderbilt Whitney, James E. Fraser, A. A. Weinman, Laura Gardin, Evelyn B. Longman, Bessie Potter Vonnoh, Chester Beach, Frederick Roth, Nellie V. Walker, Albert Jaegers, Anna Vaughn Hyatt, Edward McCartan, Mahonri Young, and Grace Mott Johnson.

Negro sculptors in the United States have done some notable work. May Howard Jackson did the statue of Paul Laurence Dunbar at Washington. Meta Warrick Fuller is represented in the Cleveland Art Museum and the New York Public Library.

Much of the newer work, both in the United States and in Europe, in its tendency to simplify, to emphasize design and reduce realism, to adhere to the abstract and avoid narrative, bears a certain kinship both to primitive and to oriental art.

In sculpture as in all things, the Orient has always been conservative. Religion, the very breath of the Orient, inspired much of its sculpture, and set certain limitations and characteristics upon it. In India, religion proscribed realism and demanded a passive countenance. The art of China gained something by a more human type of religious belief. Japan produced masterly portraits in sculpture between 1100 and 1300,



Sculpture by Nellie Verne Walker *By courtesy of The Art Institute of Chicago*

'HER SON', A MUCH LOVED AMERICAN WORK

'HER SON', A MUCH LOVED AMERICAN WORK

THE nobly idealistic group reproduced on the preceding page gained for Nellie Verne Walker a high place among American women sculptors. Of it Anna M. Denniston wrote: "The boundless hope of the youth of the world is transfiguringly expressed, and so is the selfless wonder and unrestraining love of motherhood. It seems natural to call this 'universal motherhood' and 'universal childhood', so broad is its conception."

Like all of Miss Walker's works, this group is marked by a great simplicity of line and a strong feeling of idealism.

Miss Walker was born in Red Oak, Ia., in 1874. Her father was in the monument business; and it was in his marble-working shop that Miss Walker, as a very young girl, learned to use the tools of the sculptor's art. Later she studied with Lorado Taft at the Art Institute in Chicago.

When she exhibited 'Her Son' at the Art Institute, it aroused such interest that, to satisfy the public demand, it was reproduced on thousands of post cards and in miniature copies.

but such realism is not characteristic of the Orient. No matter how the angry god's eye may frown, the dragon writhe, the drapery flutter, form always dominates emotion in oriental sculpture. The famous carvings at Ajanta in western India have movement, certainly, but under the perfect control of pattern and design. Oriental sculpture tends to be decorative, formal, even stiff; often it is purely architectural. Medieval sculpture perhaps resembles it the most, baroque the least, if we compare it to occidental sculpture. It has been little studied in centuries past. Perhaps we shall find that, in ignoring it, we have been as obtuse as those generations who scorned Gothic and ancient Greek.

How Sculptors Work

Since about 1500 the usual method in making statues in stone has been for the sculptor to make a small model in clay or wax, then a large one in the size intended for the finished statue. From this model, workmen take a hollow cast in plaster of paris to act as a mold. They brush the inside of the mold with oil to prevent sticking, fill the mold with more plaster, and when it hardens they break off the outer cast, or casing, and the solid cast appears. The process is much the same as that used in casting china doll heads (*see* Dolls). Skilled stone-carvers then copy the plaster cast in marble or some other stone. They use a pointing machine, which measures off points on the stone corresponding to certain points on the plaster cast, and thus estimate where to cut. Then they cut out the statue with hand tools. It is unusual for the artist to have anything to do with this mechanical job. However, some artists take the rough-hewn statue from the workmen and finish it themselves, thus giving it a touch of their own personality.

The sculptors of the Middle Ages, and probably the Greeks, did the actual cutting of the stone themselves, and so did Donatello and Michelangelo. Sculptors' tools vary with materials. Hard stones require drills, chisels, files, and hammers; soft stones yield to saws and toothed adzes.

Bronze statues are made by pouring the molten metal into the mold. Small works have at all times been cast solid; but larger ones, since at least as long ago as 1000 B.C., have been cast hollow. Since the later years of the 19th century, sculptors have returned to the old *cire perdue*, or "lost wax," process. They make a full-sized, roughly shaped clay model, cover it with a half-inch layer of wax, and do their final modeling on the wax. Over the wax go repeated coats of liquid clay to form a crust. Then the model is heated, the wax runs out, and molten bronze is poured into the space between core and crust. With core and crust removed, the hollow bronze remains. Benvenuto Cellini in his autobiography tells how he used this process to cast his famous figure of Perseus holding the Medusa head. Today some bronze statues are made by electroplating a model (*see* Electroplating).

—REFERENCE-OUTLINE *for Organized Study of* SCULPTURE—

FEW studies are so pleasant in themselves and so valuable educationally as the study of sculpture. The multitudes of carved figures which have been left from the earliest times tell a graphic story of the history of civilization with its changing manners and ideals. Of the life existing before the dawn of history, the most important records we possess are the crude figures in bone, horn, and ivory, which have been unearthed, and the drawings found upon cave walls.

I. KINDS OF SCULPTURE:
- A. **Decorative Sculpture: S-52, S-52 picture.**
- B. **Free Sculpture: S-52, S-61 picture.**
- C. **Sculpture in Relief: S-52.**
  - a. **High Relief:** 'Singing Boys' S-57.
  - b. **Middle Relief:** 'Roman Procession' S-53.
  - c. **Low (or Bas) Relief:** 'Assurnasirpal Hunting' S-54.
- D. **Intaglio:** S-52. Carving on Pylon, Temple of Karnak, Egypt E-208 picture.

II. EARLY HISTORY OF SCULPTURE:
- A. **Primitive Carvings: C-118, C-120, and P-3 pictures.**
- B. **Egyptian Sculpture: S-52–3.**
  - a. **Carved Objects from King Tutenkhamon's Tomb: E-199–200 pictures.**
  - b. **Sphinxes:** Sphinx at Gizeh S-248–9; Avenue of the Sphinxes E-207 picture; Sphinxes with Rams' Heads, Karnak E-205 picture.
  - c. **Portraits:** Of Ptolemy Auletes E-336; of Egyptian Official and Wife E-336; of Amenhotep III E-209; of Rameses II E-210; of Nefertiti A-250 picture.
- C. **Mesopotamian Sculpture: S-53.**
  - a. **Golden Ram of Ur: A-250 picture.**
  - b. **Sculpture in Relief:** 'Assurbanipal Slaying the Lions' B-6; 'Assyrian Soldiers' B-6; Winged Bull E-336.
- D. **Aegean Sculpture: A-27.** Statue of Snake Goddess A-26.

III. GREEK SCULPTURE: S-53–4, G-165–8.
- A. **Archaic Period: G-165.** Figure of a Woman G-166.
- B. **Attic Period:**
  - a. **Myron: G-166.** 'Discobolus' E-334.
  - b. **Polyclitus: G-166, H-281.**
  - c. **Phidias and His Disciples: P-157–8.** The Design and Decoration of the Parthenon: S-53–4, A-11, A-12, A-354, A-352, E-336, G-168, G-161; Statue of the Olympian Zeus Z-217, S-82, S-83; Influence of Phidias ('The Venus de Milo' G-166, A-227, E-333).
  - d. **Praxiteles: G-166–8, S-53.** Statue of Hermes S-55.
  - e. **Scopas: G-168, G-167 picture.**
  - f. **Lysippus: G-168.** Statue of Hercules (Copy after Lysippus) H-283, S-55.
  - g. **Other Famous Statues of the Period:** 'Villa Ludovisi Mars' G-166; 'Artemis of Gabii' E-333; 'Winged Victory of Samothrace' S-55, G-168.
- C. **Late Greek Period: G-168.** 'The Laocoön' S-53; 'Apollo Belvedere' A-228, A-229; 'Flora' E-334; 'The Wrestlers' E-335.

IV. ROMAN SCULPTURE: G-168–9, S-54. 'The Young Augustus' G-168; Portraits of Hadrian, Cicero, Hannibal, Trajan, Julius Caesar, Augustus, Scipio R-131; Relief of Trajan's Column G-169; 'Emperor Augustus' E-330; 'Antonia' S-54; 'Roman Citizen' S-55.

V. MEDIEVAL SCULPTURE:
- A. **Romanesque: S-54.**
- B. **Gothic: S-54–6.** Ornamentation of the Great Cathedrals C-100; Chartres S-56 picture; Façade, Reims C-100; Notre Dame, Paris A-266.

VI. THE RENAISSANCE: S-56, R-74–5.
- A. **Beginnings of the Renaissance in Italy:**
  - a. **Niccolo Pisano: S-56.** Pulpit E-335.
  - b. **Giovanni Pisano: S-57.** Pulpit E-331.
  - c. **Andrea Pisano: S-56–7.**

d. Giotto: G-89. Bell Tower, Florence G-90.
e. Ghiberti: G-84, S-57. Bronze Doors G-85.
f. Donatello: S-57. 'Dancing Children' S-57.
g. Luca della Robbia: S-57. 'Singing Boys' S-57.
h. Andrea della Robbia: S-57, I-170.
i. Verrocchio: I-173, S-58. Equestrian Statue of Colleoni E-334.

B. Full Flowering of the Renaissance in Italy:
a. Michelangelo: M-146, S-58. 'Moses' M-146; 'The Dying Slave' M-147; 'Dawn and Dusk' M-147; 'The Madonna della Pietà' M-148; 'Lorenzo de Medici' M-107.
b. Benvenuto Cellini: S-58. Silver Pitcher E-335; 'Perseus' S-58.

C. The Renaissance in Northern Countries: S-56.
a. France: Michel Colombe S-58 ('St. George and the Dragon' S-59); Jean Goujon S-58 ('Nymph of the Seine' from 'Fountain of the Nymphs' S-59); Germain Pilon S-58.
b. Germany: Veit Stoss, Adam Krafft, Vischer S-58.
c. Flanders: François Duquesnoy S-58.
d. Great Britain: Nicholas Stone S-58.

D. Baroque and Rococo Styles:
a. Italy: Giovanni Bernini and His Followers S-58; 'St. Theresa' S-60.
b. Germany: S-59.
c. France: S-59.

VII. THE GREEK REVIVAL: S-59–60.

VIII. MODERN EUROPEAN SCULPTURE: S-60–2.
A. François Auguste Rodin: R-124, S-61–2.
B. Other Examples: Henri Chapu's 'Joan of Arc' S-60; Sir William Thornycroft's 'Statue of Teucer' S-61; Paul Troubetskoy's 'Bust of Tolstoy' S-62; Jacob Epstein's 'The American Soldier' S-62.

IX. SCULPTURE IN THE UNITED STATES:
—Representative Masters: Frederick MacMonnies S-62; Augustus Saint-Gaudens S-7 ('Victory' S-64); Daniel Chester French S-62 ('The Minute Man' S-63); Paul W. Bartlett S-62–4 ('The Bear Tamer' S-63); George Grey Barnard S-64 ('Maidenhood' S-62); Cyrus Edwin Dallin S-64 ('Appeal to the Great Spirit' S-63); Frederic Remington, Solon Borglum S-64; Gutzon Borglum B-195, S-64 ('Abraham Lincoln' S-63); Jo Davidson S-64; Paul Manship S-64 ('Indian Hunter and Antelope' F-42).

X. ORIENTAL SCULPTURE: S-64–5.
A. India: I-41, S-64. 'Giant Bull of Siva' I-35; 'The Elephant God, Ganapati' A-329.
B. Japan: J-196, S-64–5. Ivory Carving J-202; 'Buddha of Kamakura' J-202.
C. China: S-64. Statues of Buddha C-78; Statue of Buddha, Tibet A-329; Clay Horse F-41.
D. Java: Sacred Lions J-203.

XI. METHODS USED IN SCULPTURE:
A. Methods for Stone and Marble: S-65.
B. Methods for Bronze: S-65.
C. Tools Used: S-65.

Bibliography for Sculpture

—Books for Beginners:
Barstow, C. L. Famous Sculpture (Appleton-Century, 1932).
Bryant, L. M. Children's Book of Celebrated Sculpture (Appleton-Century, 1923).
Fowler, H. N. and M. Z. Picture Book of Sculpture (Macmillan, 1929).
Gaba, Lester. On Soap Sculpture (Holt, 1935).
Gibson, Katharine. Goldsmith of Florence (Macmillan, 1929).
Wheeler, I. W. Playing with Clay (Macmillan, 1935).
Wilson, R. N. D. Sculpture Shown to the Children (Nelson, 1933).

—Books for Advanced Students and Teachers:
Casson, Stanley. Some Modern Sculptors (Oxford, 1928).
Casson, Stanley. XXth Century Sculptors (Oxford, 1930).
Chase, G. H., and Post, C. R. History of Sculpture (Harper, 1924).
Dodd, L. H., ed. Golden Age of American Sculpture (Chapman, 1936).
Jagger, C. S. Modelling and Sculpture in the Making (Studio, 1933).
Maclagan, Sir E. R. D. Italian Sculpture of the Renaissance (Harvard, 1935).
Taft, Lorado. History of American Sculpture (Macmillan, 1930).
Underwood, E. G. Short History of English Sculpture (Faber, 1933).

SEA-ANEMONE. Often at the seashore you will see, attached to the pilings or to rocks, groups of queer little creatures with petal-like tentacles waving languidly in the current, which could almost be taken for copies of brilliantly colored garden asters. These are sea-anemones, a kind of polyp which usually does not secrete a coral stock. They are found in all seas, but are especially plentiful in temperate zones.

Sea-anemones vary in size from a quarter of an inch across the extended flower face to more than a foot in diameter; only a few, however, are more than three inches across. Their bodies are short hollow cylinders of soft flesh with a spreading base. At the free end is the mouth, about which are one or more circles of tentacles. In the outer skin of the tentacles are thousands of minute stinging threads, all curled up into tiny balls, ready for use. When a small fish or other animal comes swimming along, the sea-anemone shoots out from these "lasso cells" its barbed threads, which contain a poison that paralyzes or kills its prey. Both the mouth and the body cavity can be extended and the sea-anemone often devours an animal nearly as large as itself. Indigestible waste is ejected through the mouth.

Anemones multiply sometimes by budding or by division, but usually by eggs. The young swim in the water for awhile until they find a spot on which to settle and grow. Along with most corals, sea-fans, and sea-feathers, the sea-anemone belongs to the class of *Anthozoa* or "flower-animals."

THESE ARE NOT FLOWERS, BUT ANIMALS

This group of Sea-Anemones might be taken for a view in some mysterious garden visited by Alice in Wonderland. But the Sea-Anemone is not a plant but an animal, and it can move very slowly over the rocks to which it attaches itself.

QUEER HORSES AND DRAGONS FROM THE PASTURES OF THE SEA

Sea-horses are tiny fish that look like chess-board knights. See how the frail youngster steals a ride by coiling its tail around its parent. The flexible tail has great grasping power.

These sea-horses are anchored to the branches of a tree in the artificial surroundings of an aquarium.

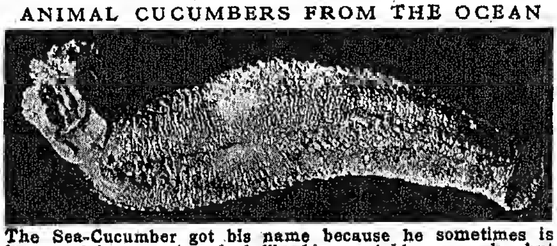
The Australian "sea dragon," near relative of the sea-horse, is a thin, shredded creature, bedecked with leafy appendages and gaily colored to mimic the seaweeds among which it dwells.

SEA-CUCUMBER. The sea-cucumber is a tropical undersea animal that looks something like our garden cucumber in shape and in the warts and spines on its skin. Its muscular body, however, is more like that of a caterpillar. It crawls along the ocean floor, either on short, tube-like legs or by wriggling like a worm. This primitive animal is called also *bêche-de-mer* (French for "sea-caterpillar"), *holothurian* (its scientific name), and *trepang*.

The various species of sea-cucumbers belong to the *Echinoderms*, a group which includes also the sea-urchin and the starfish (*see* Starfish and Sea-Urchins). Like them, the sea-cucumber's muscles and nerves have a five-pointed pattern, although the animal has lost its five-pointed shape. Around its mouth grow sensitive tentacles, with which it seizes food and which it can draw into its mouth at will.

Trepang is considered a great luxury among the Chinese, Malays, and other Eastern peoples, and gathering and preparing it for the market is a flourishing industry on the islands of the Pacific, and on the Great Barrier Reef of Australia. White men who have eaten sea-cucumber soup declare it is delicious. The trepangs, which grow from 10 to 15 inches long, are gathered from coral reefs, and are boiled and dried, first in the sun, then over a fire, which gives them a smoky taste. The highest grade when properly cured has been sold for $1,000 a ton.

ANIMAL CUCUMBERS FROM THE OCEAN



The Sea-Cucumber got his name because he sometimes is large and fat enough to look like his vegetable namesake, but more often he looks like a giant caterpillar or worm.

SEA-HORSE. With a head shaped like that of a tiny prancing pony, a body encased in rigid plates and thorny spines, and a tail like a snake's, there is little about the "sea-horse" to suggest that it is really a fish. Nor do its habits follow those of other fish. At times it swims upright through the water with the aid of its single back fin, but usually it remains at rest with its tail curled around a bit of seaweed to keep from being swept away. Thus anchored, it looks like some strange pigmy dragon out of a fairy tale.

But perhaps the most peculiar thing about these creatures is the way they care for their eggs. The male carries them around in his "vest pocket," a sort of pouch like a kangaroo's, until they are hatched. Even after the young hatch out, they remain in the paternal pouch for a time until they are old enough to forage about for themselves.

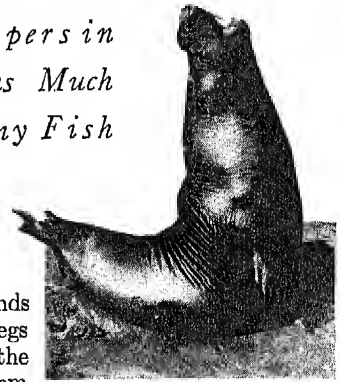
Sea-horses are found in small numbers in nearly all of the warm and temperate seas. They belong to the pipe-fish family, but they are feeble swimmers. Clothed in bony plates and spines, and closely resembling in color the weeds among which they dwell, they are able despite their helplessness to escape their many enemies. Their food consists of small sea creatures and the eggs of other fishes.

There are some 50 species of sea-horses, ranging in size from 2 to 12 inches. The common sea-horse of the Atlantic coast of North America (*Hippocampus hudsonius*) reaches a length of about six inches. An olive green sea-horse (*Hippocampus zosterae*), the smallest known species, is abundant in shallow water in the lagoons along the Florida coast.

LAND ANIMALS *That* TOOK *to the* SEA

How the Seal Tribe Gained Flippers in Place of Legs and Now Feels as Much at Home in the Ocean as Any Fish

A SEA LION



AN ELEPHANT SEAL

SEAL. On an ice floe in the Arctic sea an Eskimo stands waiting, harpoon in hand. At his feet is a hole he has cut in the ice. Down in it, sea water gurgles and swishes. The wind is bitter, but the hunter endures it, because he expects a seal to bob up in the hole to breathe. He must harpoon it in order to eat.

Before long he spears a seal, and then for a time he is rich. He saves the hide to furnish material for boots and a coat and to help cover a boat. His wife cooks the meat and serves the blubber, or fat, as dessert. She also burns some of the fat in a stone lamp to furnish light and heat. Indeed, this one seal may serve all the family needs for a week.

Many Eskimos depend in this way upon the seal, though most of them use more modern methods of hunting (*see* Eskimos). Explorers too use seal meat and fat for food, fuel, and to feed dog teams. In milder climates, seals are hunted for oil from their fat. In most lands, sealskin coats, obtained from the fur seals of the North Pacific, are prized luxuries.

HUNTING A SEAL IN WINTER

When a seal bobs up in the hole in the ice to breathe, the Eskimo will spear it. Then he will have food, heat, and light for a week.

Seals are odd animals. First of all, they are mammals. This means that they have warm blood, they breathe air, and they bear living young on land. But they spend most of their time swimming like fishes in the water, hunting squid, fish, and shellfish. The seal can do this, though it is a mammal, because it is fully adapted to life in the water. A thick layer of fat protects the warmth in its blood. It can close its eyes and ears when it dives. The lungs hold air enough to permit staying under water several minutes.

Each leg has been made into a flipper for swimming. The forelegs are free from the body, and the seal can rear up on them or use them to pull itself along the ground. In some kinds of seals, the hind legs point forward, and the animal can use them for getting about on land. In other kinds, the hind legs trail backward and serve only for swimming. These seals move on land like caterpillars by arching the back to draw the hind parts forward, then lunging ahead with the fore parts.

The Common, Harbor, or Leopard Seal

The best-known seal is the common, harbor, or leopard seal (because of its yellowish spots). Its skin is covered with coarse hair and is useless as fur. It is found on most ocean coasts, unless the water is warm. It goes to sea for food, but otherwise it remains always on the same rocky point or island.

In North America, common seals live along the Atlantic coast as far south as the Carolinas. They range the Pacific coast from Mexico to the Bering Sea, and they have been found in the St. Lawrence and Yukon rivers. In the days before kerosene was used for lighting, men hunted the common seal everywhere for its oil. Now the only big hunt occurs around Newfoundland in the spring.

The Migratory Fur Seal

Today the most valuable seal is the fur seal of the North Pacific and the Antarctic oceans. This seal belongs to the type which has useful hind limbs. It is distinguished from others of this family because it has a soft, dense fur next to the skin. Coarse "guard hairs" grow through this and provide an outer hair coat like that of other seals.

Fur seals are noted for the great range of their migrations. The full-grown males, or bulls, remain in the polar regions the year round; but the females and the young males migrate in winter almost to subtropical waters. The North Pacific herds go as far south as a line from San Diego to Shanghai (about 30° north latitude). In spring these herds start northward off the coasts for the summer breeding season.

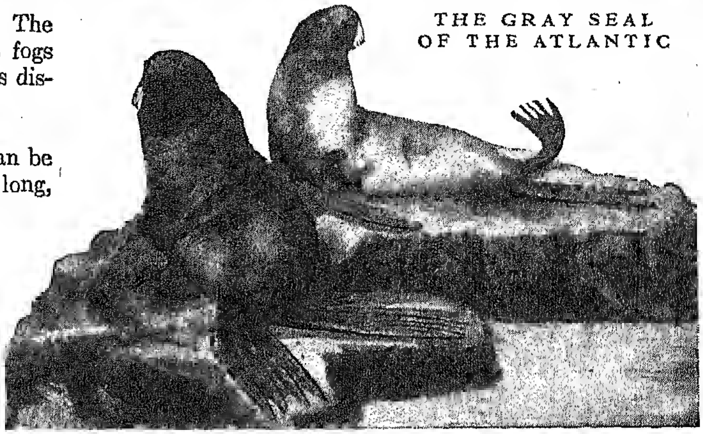
By late May the bulls of these herds establish themselves on the Pribilof Islands of the United States, the Russian-owned Commander Islands, and the Japanese-

owned Kuril Islands and Robben Island. The seals like these islands because frequent fogs keep the sunlight subdued. This prevents discomfort while they are on land.

The Breeding Season in the Rookeries

The bulls—seven years old or more—can be recognized by their size. They are six feet long, weigh 500 pounds or more, and have "wigs" of heavy hair over the head and the neck. Each bull takes a stretch of beach as his own and keeps others away. As the young males, called "bachelors," arrive, the bulls force them to herd by themselves. In June the females, or "cows," arrive, and 50 or 60 of them gather around each bull. Soon each cow which is three years old or more gives birth to one pup. Then the cows go to sea to feed, and return to nurse their pups.

THE GRAY SEAL OF THE ATLANTIC



These are hair seals, without a furry undercoat. We can tell that they are not fur seals because their hind flippers point backward. The yellowish-gray coat is often bedecked with darker spots. Gray seals are one of the largest species. The males grow to a length of ten feet or more; the females are much smaller.

In August the pups are old enough to learn how to swim and hunt. The mother pushes her pup into the water and lets it flounder until exhausted. Then she takes the pup under her flipper to rest. Within a week the pups can swim, play games, and begin to hunt. In September the females and the pups start south, and the bulls swim away.

Government-Controlled Sealing

On the Pribilofs the United States allows only three-year-old bachelors to be killed for their skins. The skin of younger ones is too small, and on older ones the fur is too coarse.

Before the killing starts, the officials estimate the size of the herd and mark one bachelor for every 40 three-year-old females by clipping off some fur. The native workers then drive all the bachelors to a convenient spot and kill the unmarked ones with a blow upon a weak spot in the skull. The hides are taken and sent in salt to the United States. The number taken has grown from 3,191 in 1912, the first year of government operation, to upwards of 60,000, as the herd grew under protection from about 200,000 in 1912 to more than 2,000,000.

Dressing and Marketing Sealskins

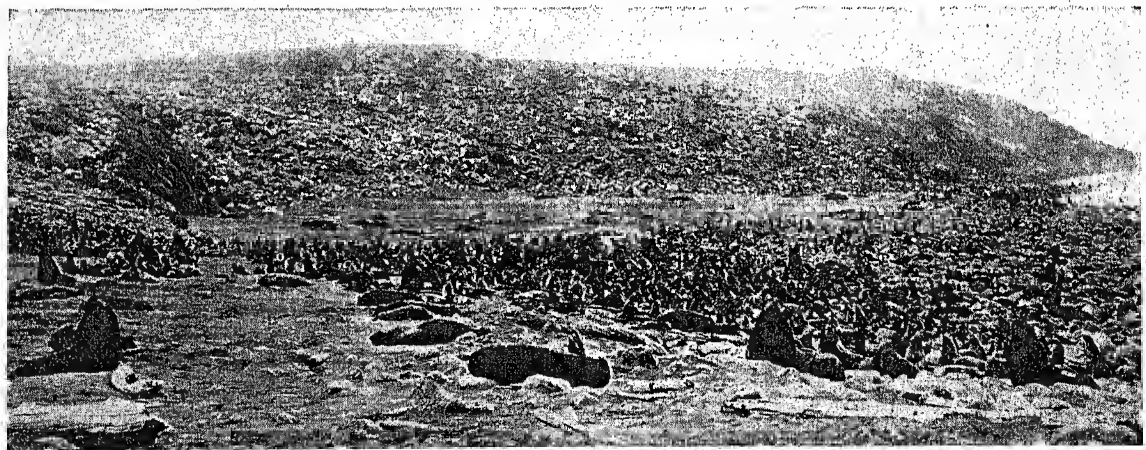
All the furs are dressed for the government in St. Louis. After the skins are washed, stretched, and dried, the coarse guard hairs are removed. Most of them are scraped off with a dull, two-handled knife. The shortest ones are sheared off, after the underfur has been blown from beneath the shears with a strong blast of air.

Next the skins are placed in machines which work in oil and tumble the skins about to soften them. Then they are dyed a deep black or logwood brown and graded for quality. The finished skins are sold at auction, at an average price of between $40 and $50 each. From six to eight go into one coat.

The Long Struggle to Save the Seals

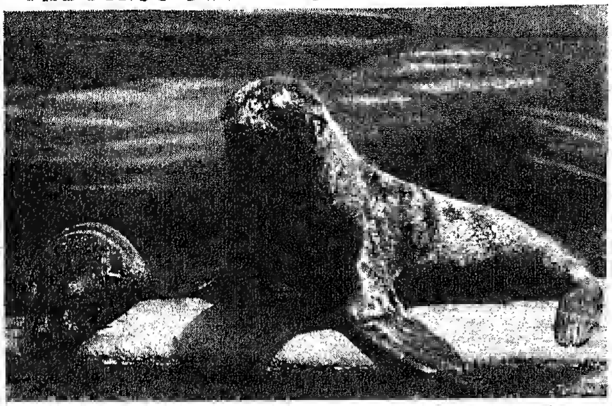
The world still has these Pribilof Island seals because of one of the longest and hardest fights in all the

A SEAL ROOKERY ON THE PRIBILOF ISLANDS



Here are a few of the millions of fur seals that spend the summer on the Pribilof Islands in the Bering Sea. The large animals with up-reared heads are "bulls," keeping jealous watch over their wives; scattered through the throng can be seen a multitude of young seals, called "pups." The young males, called "bachelors," must stay away from the main herd and keep to a special path when they go down to the water to feed. If one strays from the path, the nearest bull attacks; and then comes a battle to the death.

THE FIRST OWNERS OF SEALSKIN COATS



Fur seals grow a soft undercoat beneath the surface guard hair, and this undercoat provides our highly prized sealskin. You can see that these are fur seals because they have external coverings which close the ears, and their hind limbs point forward.

history of conservation efforts. When the United States bought Alaska from Russia in 1867, the Russians had learned to protect the seals against indiscriminate hunting. The United States tried to do this by granting a 20-year monopoly to a private company, in 1870 and again to another company in 1890. Each company tried to guard the herd in order to protect its business.

But many hunters killed seals while the herds were at sea. This hunting, called "pelagic" (*pĕ-lăj'ĭk*) from a Greek word meaning "sea," threatened to exterminate the seals through loss of females. The company appealed to the government, and in 1892 the United States asked Great Britain and Japan to join in forbidding pelagic sealing. But they would only agree to suppress hunting in a 60-mile zone around the Pribilof Islands.

By 1911 the herd was almost extinct, and Great Britain and Japan were willing to help save what was left. On July 7, 1911, they and the United States agreed to the North Pacific Sealing Convention, to become effective the following December 15 for 15 years. This treaty forbade pelagic sealing north of 30° north latitude, and left each government to regulate hunting on its islands. Each government agreed to share the hides taken on its islands, or the revenue from them, with the others. The treaty was to be renewed automatically unless one of the nations denounced it. Japan did this Oct. 23, 1940.

The treaty allows Indians and Eskimos to kill fur seals, if they use nothing but native canoes and weapons. This hunting takes only a few thousand fur seals a year. American and Canadian Coast Guard vessels accompany the herd wherever necessary to enforce the provisions of the treaty. The United States maintains officials and a few hundred Aleutian natives on the Pribilof Islands, and visitors can land only with special permission. The government provides the natives with all necessities, schools, and medical attention, and pays a small sum every year as wages.

Sea Lions and Sea Elephants

The fur seals have close relatives in the sea lions of the Pacific coast. These animals have external ears, like fur seals, but they have no underfur. The hair coat is glossy only when wet. Sea lions learn tricks readily; hence circuses and zoos use them for "trained seal" acts.

Sea lions are much like fur seals in their habits, except that they do not make extensive migrations. There are two kinds, the common one, found from southern Mexico to northern California, and the larger Steller or northern sea lion. This species ranges from about San Francisco northward to the Bering Sea.

The giant of the seal tribe is the sea elephant, also called elephant seal. There are two species, the northern and the Antarctic. Males of the northern species may grow to be 18 feet long; the Antarctic ones grow slightly larger. In each species, the females are about half the size of the males. The males have a short trunk, or proboscis, which they inflate when excited. The northern species was common on the Californian and Mexican coasts until it was hunted almost to extinction for its oil. The few survivors on Guadalupe Island near San Diego are now protected. The Antarctic species has again become fairly numerous as the result of limited protection.

WHO'S WHO AMONG THE SEALS

Seals, sea lions, and sea elephants belong to the order (or suborder) *Pinnipedia* and are grouped in two families, the *Otariidae* or Eared Seals and the *Phocidae* or Hair Seals. The *Otariidae* have external ears and their hind legs point forward. The *Phocidae* (also called "true seals") have no external ears and their hind legs point backward.

Otariidae

California Sea Lion (*Zalophus californianus*)—Brown to dull black; males about 8 ft. long, about 500 lbs.; Pacific coast of North America.

Steller or Northern Sea Lion (*Eumetopias jubata*)—Yellowish brown to dark brown; males from 1,500 to 1,800 lbs.; Bering Strait to California.

Alaska or Northern Fur Seal, or Sea Bear (*Callorhinus alascanus*)—Soft underfur; 300 to 500 lbs.

Phocidae

Common, Harbor, Hair, or Leopard Seal (*Phoca vitulina concolor*)—Yellowish gray to black, spotted with brown or yellow; about 5 ft. long.

Ribbon Seal (*Phoca fasciata*)—Brown with bands of yellow about neck, shoulder, and rump; Aleutian Islands and Alaska coast.

Ringed Seal (*Phoca hispida*)—Dark brown, small yellowish rings; polar seas.

Greenland, Harp, or Saddle-Back Seal (*Phoca groenlandica*)—Males yellowish with bands of brown crossing over shoulders; about 6 ft. long; polar seas.

Bearded Seal (*Erignathus barbatus*)—Grayish to yellowish; long bristles around muzzle; from 10 to 12 ft. long; polar seas to Newfoundland.

Gray Seal (*Halichoerus grypus*)—Silver to gray, blackish spots; up to 10 or 12 ft. long; Nova Scotia to Greenland.

Hooded Seal (*Cystophora cristata*)—Slaty black spotted with whitish; males have inflatable bag of muscular tissue on top of head; from 7 to 8 ft. long; Newfoundland to Greenland.

Sea Elephant or Elephant Seal (*Mirounga angustirostris*)—Brownish to slaty; up to 20 feet long.

SEASONS. The sharpest reminders of the passing year are the coming of its four seasons, one by one. The calendar year begins in *winter*, an ancient Teutonic word meaning "time of water"—rain and snow. This is followed by *spring*, again Teutonic for "time of haste"—all nature indeed seems in a hurry then. Next comes *summer*, another Teutonic word so old its first meaning is forgotten. The year draws to a close in *autumn*, a Latin word. Poets called this season "the fall of leaves," which has been shortened to *fall* for common use.

The seasons are caused by the slant of the earth's axis as it moves around the sun, as illustrated on page E-133. When the north pole is inclined toward the sun, the northern hemisphere has its summer. When the north pole is inclined away from the sun, the northern hemisphere has its winter. In the southern hemisphere these seasons are reversed.

Sailors and shepherds of olden times knew when the seasons approached by watching the stars. When they looked at the eastern sky in early evening and saw Sirius, "the Dog Star," and Castor and Pollux, "the Twins," they knew that winter was but a few weeks away. The appearance in the east of Leo, "the Lion," showed that the middle of winter was past, and spring was sure to follow. The red star Antares was a reminder that summer was coming, and Pegasus, "the Winged Horse," gave notice that autumn was at hand.

Ancient men watched the sun too. Long ago they learned that the noon sun is highest in the sky about June 22, lowest about December 22, and midway about March 21 and September 23. The season of high noon sun gives many hours of summer daylight and few of darkness; when the noon sun is low, we have few hours of winter daylight and many of darkness. The spring and autumn suns give days and nights more nearly equal. (*See* Equinox and Solstice.)

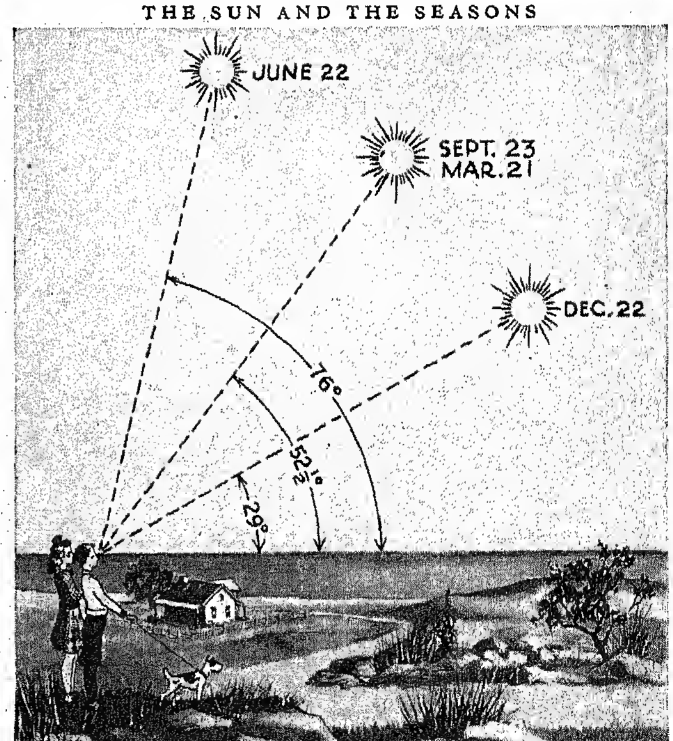
Weather varies with the seasons because (except in the tropics) the sun's rays are more slanting in winter as the earth's axis tilts away from the sun, and less slanting in summer as the axis tilts toward it. The effects of this change in slant of the sun's rays are explained in the article Climate. It is worth noting that the earth is about 3,000,000 miles nearer the sun in our northern winter than it is in summer. This is explained on page E-132.

The illustration at the right shows strikingly the 47-degree difference between the position of the noon sun in summer and winter, and the difference in the slant of its rays. If the earth's axis did not tilt, the noon sun would be directly overhead at the Equator all the time and would approach the southern horizon as the observer moves toward the north pole. In latitude 37½° N., the noon sun would be lowered by this amount from the overhead (zenith) position, 90° above the horizon, and would stand 52½° above the southern horizon. This is its position at the vernal and autumnal equinoxes, when the seasons are evenly balanced between the northern and southern hemispheres. At the summer solstice it is 23½° higher than 52½°, or 76° above the horizon. In winter it is 23½° lower, or 29° above the horizon.

The dates of the solstices and the equinoxes are commonly taken as the beginnings, not the midpoints, of the seasons. In the northern hemisphere the coldest days come *after* the sun has reached its lowest noon position on December 22, because the earth gives up but slowly the heat absorbed in summer. So December 22 is taken as the beginning of winter instead of the middle. Spring begins on March 21, summer on June 22, autumn on September 23.

Of all things on earth, the plants are most affected by the seasons. In spring their leaf and flower buds open, fertilization takes place, and new rings start under the bark of trees. Summer is the time of plant growth in the long hours of sunshine that provide energy for the starch factories in their leaves (*see* Plant Life, subhead "Photosynthesis"). Autumn is the time of ripened fruits, when leaves, their service over, dry colorfully and fall (*see* Leaves). Winter is a time of death for many plants and of resting for the others. Buds are tightly waxed to keep out the ice, and seeds

THE SUN AND THE SEASONS



If you stood halfway between the northern and the southern limits of the United States—at latitude 37½° N.—you would see the noon sun at these different heights above the horizon on these dates. On which dates would you cast the longest shadow and the shortest?

have hard coats for their protection. (*See also* Flowers; Trees.)

Many animals are greatly affected by the seasons. Birds migrate to escape the cold, and nearly all furry creatures get new, thick coats in autumn. Many eat to fatness and then sleep through the winter (*see* Hibernation). Creatures that neither migrate nor hibernate seek protection. With the coming of spring, birds, insects, reptiles, and mammals multiply and the woods become noisy with their calls. Summer is a working time and autumn a feasting time for all the animals. Some of them—chiefly the insects—cannot endure the winter, but their eggs or pupas are well protected (*see* Insects).

The human family too makes many adjustments to the seasons. Clothes of different weight and kind are worn; different foods are eaten. We have baseball in spring and summer, football in autumn, and ice hockey in winter. Farmers plant, cultivate, and harvest crops in the warm months and cut wood in winter. Similarly, building construction, lumbering, transportation, the electric power and light industry, and many other occupations are closely related to the changing seasons.

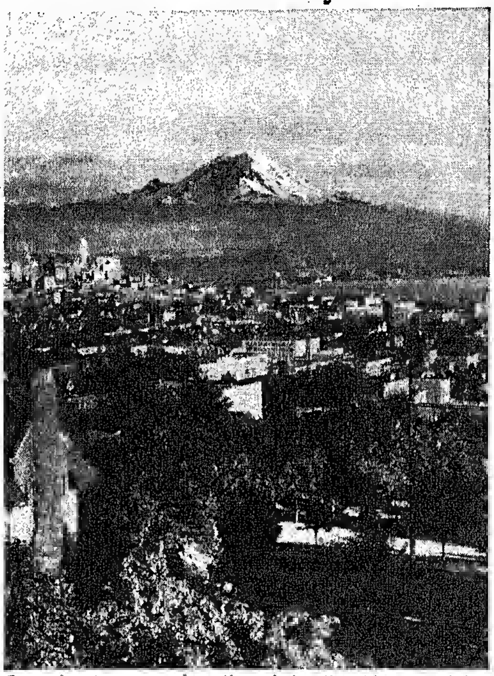
SEATTLE—METROPOLIS *of the* NORTHWEST

SEATTLE, WASH. To understand the greatness of Seattle, a visitor needs only to approach the city from the Pacific Ocean through Juan de Fuca Strait and Puget Sound. As he travels southward along the sound, between the snow-capped Olympic Mountains on the west and the towering Cascades on the east, he sees ships everywhere. These ships are one key to the city's importance and rapid growth.

Some of them carry most of the trade between the United States and Alaska. Others ply between Seattle and other Pacific coast ports, to Atlantic ports and Europe through the Panama Canal, and to South America. Still others normally carry a huge Oriental trade, because Seattle is the nearest American port to Japan and China.

Scenery and Climate

As the visitor draws near the city, about 144 statute miles from the ocean, he gets a superb view of its beauty and natural advantages. It stands on a ridge of hilly land between Puget Sound on the west and Lake Washington, an expanse of 20 square miles of fresh water, on the east. Dominating the scene is Mount Rainier, a glacier-ridged extinct volcano 14,408 feet high, about 60 miles to the southeast. Mount Rainier is one of the most majestic of American peaks, because its lofty cone rises almost from sea level.



Crowning the many beauties of Seattle, Mount Rainier rears its snow-clad head some 60 miles to the southeast. This view was taken from Queen Anne Hill, looking over the central business district toward the mountain.

FACTS ABOUT SEATTLE

Population: 368,302 (1940); metropolitan district, 452,639. Growth of city: *1870*, 1,107; *1880*, 3,533; *1890*, 42,837; *1900*, 80,671; *1910*, 237,194; *1920*, 315,312; *1930*, 365,583.

Area (Land): 58.5 square miles; of metropolitan district, 141.4 square miles.

Climate: *Mean Temperatures*—daily high, 73.2°F. (July), low, 35.7° (Jan.); monthly high, 63.1° (July, Aug.), low, 30.5 (Jan.); annual mean, 51°. *Precipitation*—annual, 34.03″; monthly high, 5.60″ (Dec.), low, 0.63″ (July).

Principal Water Shipments: Lumber, grain, flour, canned milk, canned fish, fruit, copper, paper.

Principal Manufactures: Shipbuilding, flour and other rolling-mill products, foundry and iron-works products, wood products, meat, canned fish, airplanes.

Mount Rainier, the Olympic Mountains to the west, and the Cascades on the east offer the finest camping, fishing, and hiking in the summer, while unmelting snow on the peaks offers winter sport the year round. Puget Sound and Lake Washington give innumerable opportunities for water sports. These recreational advantages can never be reduced or spoiled, because the Mount Rainier and Olympics areas are national parks, and most of the Cascade Range is within the Mount Baker, Columbia, and Snoqualmie national forests.

Everyone can enjoy these advantages the year round because of the favorable climate. The near-by ocean prevents extremes of heat and cold. Many winters pass without snow, and summer temperatures never reach 100°F. Ample precipitation provides rich growth of plants, trees, and flowers; but three-fourths of it occurs between October and March. Rain rarely mars any summer activity.

Trade and Industry

Seattle's business advantages are a match for its beauty. The principal business and shipping district stands where Elliott Bay bites into the land from the sound, and provides salt-water wharfage for about 120 full-sized vessels at a time. A canal,

opened in 1917, gives access to the lake, where the fresh water kills barnacles. Ships enter the canal through a lock 825 feet long, 80 feet wide, and 29 feet deep at low tide. The only larger locks are those at Sault Sainte Marie and in the Panama Canal.

SEATTLE'S BACKGROUND OF LAKE AND MOUNTAIN

This airplane view, taken from above Puget Sound, looks northeastward across Seattle to the snow-capped Cascade Mountains. At the far left is Mount Baker, about 90 miles away. In the near right background is the 26-mile stretch of Lake Washington; in the foreground, at the extreme right, is the city's tall Smith Tower. Along the water front are some of Seattle's many wharves.

Connections by land are provided by four transcontinental railroads, two air lines and a network of fine highways. In order to provide shorter highway connection with the east, Seattle in 1940 completed an engineering marvel—a highway carried across Lake Washington on pontoons made of reinforced concrete.

Most of the industries are on the Lake Washington Canal, the water front, and the Duwamish Waterway, a canalized river through the south part of the city. Probably the best-known industry is the Boeing Aircraft Company. It was started before the World War of 1914–1918 by the son of a Seattle lumberman, and it has pioneered and led in producing every type of airplane but particularly large transports, flying boats, and heavy bombers.

The city provides a great aid to industry with cheap hydroelectric power from the Cascades. To obtain this power the city developed the Skagit River in northern Washington in three steplike stages: The Gorge Dam, nearest the sea, completed in 1924; the Diablo unit (1930) halfway up; and the Ross Dam on Ruby Creek, started in 1938 to impound flood water high up in the mountains. Release of this water throughout the year will generate 1,120,000 horsepower. The city-owned traction system was modernized in 1939 with motor and trolley busses. The city's water supply is obtained from the Cedar River in the Cascades.

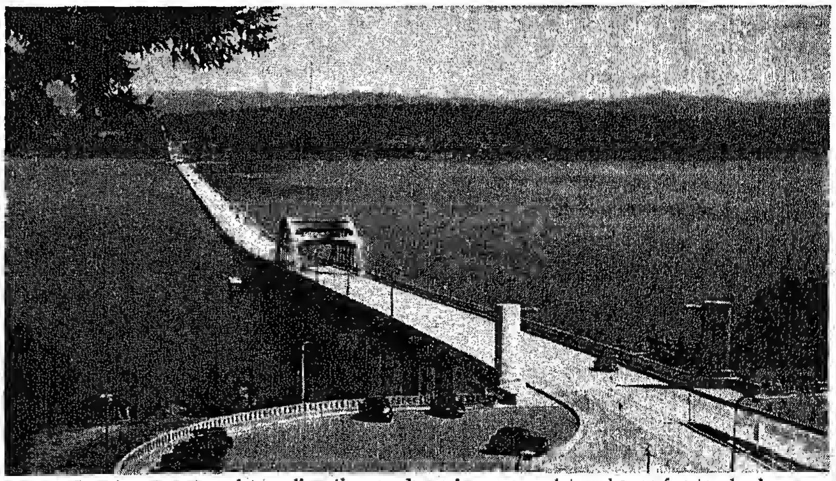
A daring improvement, completed early in the 20th century, was the removal of Denny Hill, an obstacle to the northward expansion of the central district. The entire hill was washed into Elliott Bay, and the material was used to increase harbor facilities.

The municipality has nearly fifty parks, large and small, and almost as many playgrounds; it also maintains golf courses, museums, and a zoo. Volunteer and Kinnear parks contain hills which afford superb panoramas of the city and surrounding country; Roosevelt Park preserves an area of natural forest. The city also contains Green Lake, adjoining Washington Park, and Lake Union, a part of the Lake Washington Canal. A municipal auditorium seats 6,500 and an adjoining arena, 9,000. A noted private structure is the 42-story Smith Tower, in the central district.

The University of Washington occupies a beautifully wooded 582-acre campus along the ship canal near Lake Washington. The United States Army maintains Fort Lawton within the city limits, and the Navy has an airport on Lake Washington.

Seattle takes pride in the fact that about half the homes in the city are owned by their occupants. Most

A HIGHWAY ON CONCRETE PONTOONS



In 1940 Seattle cut eastward traveling time an hour for cars and two hours for trucks by completing an engineering marvel, a fine highway floated on concrete pontoons, across Lake Washington. The pontoons can be seen beneath the roadway beyond the arched bridge. A load of 25 automobiles would sink one pontoon only one inch. The floating section is 6,561 feet long.

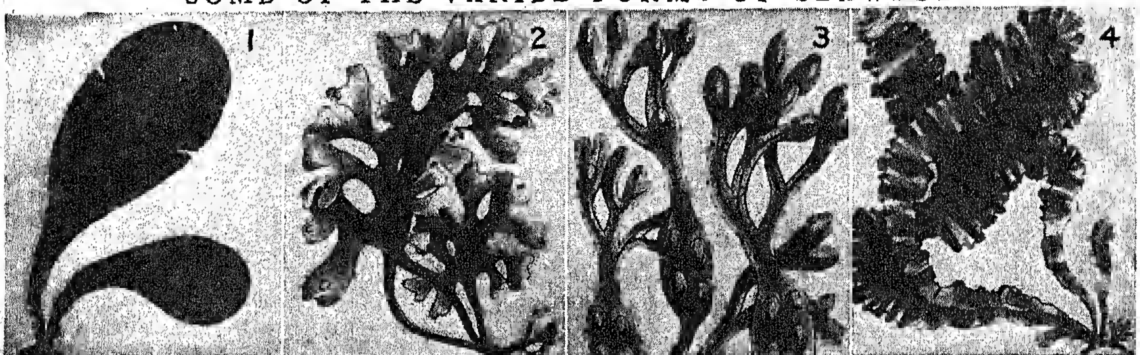
of the residential sections have unusual charm, thanks to many hills and because the favorable climate makes it easy to maintain trees, fine lawns, and a wealth of flowers. Seattle also claims to have one of the lowest city death rates in the country.

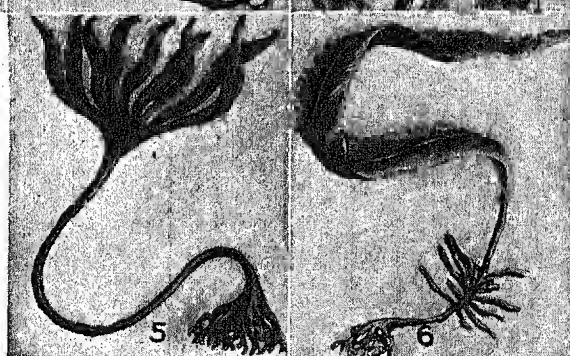
The Story of Seattle's Rapid Growth

Seattle's history started Sept. 28, 1851, when a few settlers built homes on the north shore of Elliott Bay. Next year they moved to the site of the present central district. The town was named for a friendly Indian chief; it was incorporated as a city in 1869.

Growth remained slow until the start of transcontinental train service in 1887. Two years later a fire swept the business district; but this gave a chance to build anew when rapid growth began. The start of transpacific steamship service in 1896 and the first shipment of gold from Alaska in 1897 produced more than a fivefold increase in population between 1890 and 1910. Thereafter growth was supported by development of the surrounding territory and opening of the Panama Canal in 1914. The Alaska-Yukon-Pacific Exposition was held on the present site of the University of Washington in 1909.

SOME OF THE VARIED FORMS OF SEAWEED





1. The *Iridea edulis*, better known as Hide-Weed. 2. Carrageen or Irish Moss, an edible variety of the red seaweeds. 3. Rock weed (*Fucus vesiculosus*), one of the brown seaweeds. 4. Sea Lettuce (*Ulva latissima*), a green weed. 5. Deadman's Hand (*Laminaria digitata*). 6. Wingweed (*Laminaria esculenta*). Both the Deadman's Hand and the Wingweed belong to the group known as kelps.

SEA-URCHIN. This small sea animal, with its spiny shell, is closely related to the starfishes. There are many varieties of these interesting creatures found among the rocks along the seashores and on the ocean bottom. The common green sea-urchin (*Strongylocentrotus drobachiensis*) of the rocky New England and Pacific coasts is a round cushion-shaped creature with a shell of beautifully patterned limy plates underneath its thicket of spines. The smooth flat sand-dollar (*Echinarachnius parma*) is another familiar form found on sandy shores and admired for its curious markings. (*See* Starfish and Sea-Urchins.)

SEAWEED. A great floating meadow of seaweed—the famous Sargasso Sea—almost as large as a continent, lies in the North Atlantic Ocean, massed together by winds and ocean currents from the Caribbean Sea and Gulf of Mexico. It is a tangled fairy forest, the resting place for wandering albatross and petrel, and the home of tiny fishes, mollusks, crabs, jellyfish, sea worms, and other many-colored deep-sea creatures, which dart in and out, reminding us of Coleridge's lines—

> Blue, glossy green, and velvet black,
> They coiled and swam; and every track
> Was a flash of golden fire.

Through such masses of seaweed the ships of Columbus sailed for two weeks on his first voyage to the New World, and other enormous floating islands of seaweeds exist in the Pacific and Antarctic oceans. They are composed chiefly of the variety called "gulf weed," a long many-branched plant buoyed up by little air-bladders that look something like grapes. Many other kinds of seaweed are found all over the world, growing in both fresh and salt water. They are blue-green, green, brown, and red; and range in size from the little blue-green slimes found on ponds to the giant kelps, sometimes 150 feet long, with tough, leathery, rootlike branches.

They are useful as well as interesting and beautiful—these plants of the lakes and ponds and rivers and sea. Not only do they form breakwaters that prevent the wear and tear of waves on the coast, and sometimes make natural harbors; not only do they serve the useful purpose of throwing off oxygen and keeping the water pure; but they also form the real basis for ocean life, since the larger water creatures live on the smaller ones, which feed upon seaweed.

Kelp ash was formerly an important source of the alkalis used in manufacturing soap and glass, and the chief source also of iodine; but nowadays its chief value is as a fertilizer, since its rich potash content makes it a valuable enricher of worn-out soils. Many varieties of seaweeds, such as "Irish moss" or carrageen, are edible, containing a considerable proportion of gelatinous nutriment. Cattle and horses used to rough pastures thrive on it, and we also like it in blanc mange, and in jellies and soups. Many thousands of pounds of Irish moss are gathered at low tide along the rocky coasts of Ireland and Massachusetts Bay. When the tide rises the people go out in small boats and gather in the moss with rakes. Sometimes seaweed is used by upholsterers for stuffing mattresses, chairs, and couches; sometimes it is used in the manufacture of paper; sometimes it makes a kind of gelatin; and sometimes all sorts of little dolls and baskets and trinkets are formed out of dried kelp. The gigantic kelps along the northwest coast of America were once used by the natives for ropes, and the huge bladders, as large as kegs, served as water bags.

The term seaweed includes the simple kinds of algae, but not aquatic mosses, liverworts, fernworts, and flowering plants (*see* Algae).

SECRETARY BIRD. As snake killers, secretary birds are of great value in their native home of South Africa. They are protected by law and farmers often keep them about their premises to destroy vermin, for their diet includes frogs, insects, lizards, and small tortoises, as well as snakes.

FOE OF SNAKES

The Secretary Bird is not as mild as his name might indicate. This one is toying with a snake, a delicacy of which the bird is very fond.

Secretary birds (*Sagittarius serpentarius*) are perhaps so called because of a tuft of quill-like feathers projecting from the back of the head and neck, making the profile view resemble that of a clerk or secretary with a number of quill pens behind his ear. They are also called "serpent eagles." The birds have very long legs and are about four feet high, with a tail that reaches the ground. The beak is strong and hooked, and the plumage is bluish gray and black. They run with the speed of a horse, and when forced to do so will take to the air and fly to considerable heights. They build bulky nests in trees or bushes. The secretary bird forms a family by itself, related to the vultures.

SEDAN, FRANCE. It was Nov. 7, 1918, four days before the armistice that ended the World War. American troops of the First Army, by the victorious battle of the Argonne, had cut the German communications and brought the town of Sedan under their guns. Now the doughboys of the "Rainbow Division" stood lined up by the roadside, ready to march across the Meuse and carry the Stars and Stripes into the town.

But before they entered, they sent ahead of them a column of French soldiers. The town of Sedan had been a symbol of disaster for France for many years. There, 48 years before, the last desperate battle of the Franco-Prussian War had been fought, in which Napoleon III and 86,000 men surrendered to the Germans. So the Americans stood aside and allowed the French to enter and claim Sedan first. In May 1940, in the "Battle of the Meuse," the Germans recaptured Sedan, which they had made the "hinge" of the German flank moving westward through Holland and Belgium and into France.

Sedan is situated on the right bank of the Meuse River, 64 miles northeast of Reims. It has coal and iron mines, and it manufactures cloth, machinery, and flour. Population, about 20,000.

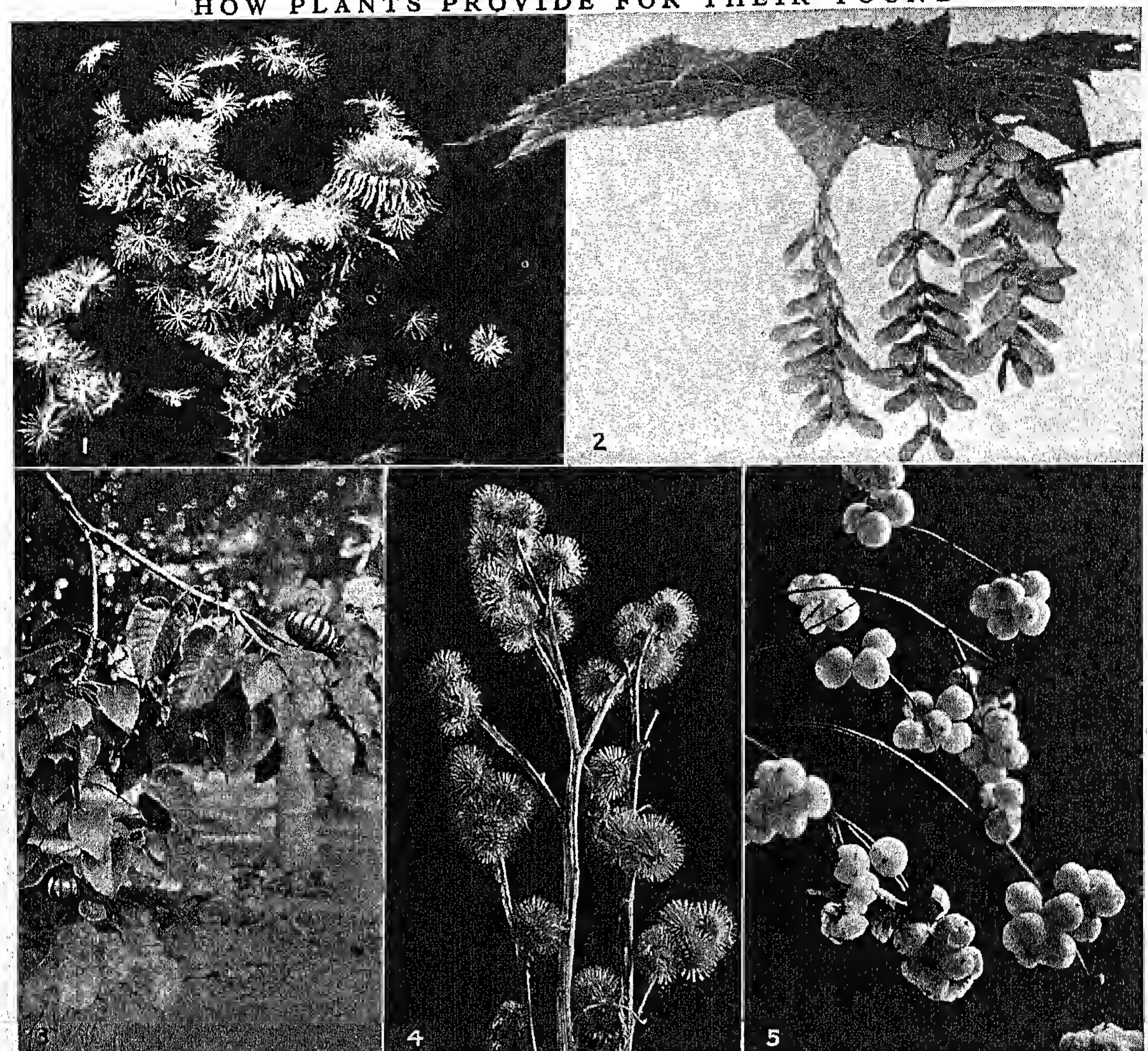
The *sedan chair*, contrary to popular belief, did not get its name from this city but rather from a Spanish word meaning "chair" or "saddle." This form of conveyance, which was popular in Europe in the 17th, 18th, and early 19th centuries, had a closed, upholstered body seating one person and was carried on poles by two bearers. From its name we get the term *sedan* for a closed automobile with a single compartment.

SEDGE. The sedges are a large family of plants closely resembling the grasses and rushes, and are found thickly bunched in damp places. There are thousands of species, about 200 of which are found in North America. The sheath which enfolds the triangular stem is solid, while the grasses usually have the stem sheath split on one side. This difference is often the only feature by which the two can be distinguished. The spikelets of sedge flowers are small and inclosed by one scale instead of two, as is the case with grasses. In general the sedges are of little use to man, the coarse fodder being rejected by animals on account of the solid dry stems. The tubers of a few species are good to eat, while the fragrant roots of another are made into perfume. The generic name of the sedges is *Carex*.

SEEDS AND SPORES. Travelers in the West Indies are sometimes startled by a report like a pistol-shot, followed by a volley of large seeds rattling through the surrounding vegetation. And if one of the seeds should strike them at close range it would leave a mark they would be likely to remember the rest of the day. This is the effective way the sand-box tree, or "Monkey's dinner bell" (*hura*), takes to scatter its seeds so that when the new plants grow up they will not be crowded together on exhausted soil. Many other plants have such "sling-fruits," which burst violently when they are ripe and jerk the seeds out to a considerable distance. Examples are the wood-sorrel and pansy.

This explosive method is only one of the ways by which plants sow their seeds in fresh soil. Many

HOW PLANTS PROVIDE FOR THEIR YOUNG



Plants have scores of ingenious ways of scattering their seeds so that the next generation may start life in fresh and unexhausted soil. Some plants and trees, like the Carline Thistle (1) and the Striped Maple (2), trust to the wind to carry their seeds to fertile ground. The Monkey's Dinner Bell (3) is more energetic, perhaps because it lives in the warmer parts of South and Central America; its seeds are contained in separate capsules which explode with a loud report and are shot far away from the seed cluster. The Lappa or Burdock seeds (4) spread by sticking to animals, and the Bayberry (5) attracts birds which carry away the seeds sticking to their beaks or feathers.

seeds, or the fruits inclosing them, are especially adapted for transport by wind. The fruit of the basswood has a wing which acts like a parachute, sailing along with the breeze and carrying the fruit with it. Dandelions and thistles grow tufts of soft hairs, which float on the merest breath of air. Others have wings circular or paddle-shaped, like the elm-fruit or the "keys" of maple, ash, and tulip tree, which twirl in the air or fall like a stone according to their design. Other seeds are so light that they are blown about like dust. Again, the seed head, or even the whole plant, as in the tumbleweed, twists itself into a globular basket, inclosing the seed pods, and rolls before the wind, carrying and scattering the seed broadcast over the countryside.

The fruits of many plants growing in or near the water are provided with life preservers in the shape of air-filled coats, or bladder-like floats, to enable them to travel on the current. The tough shell of the coconut is water-tight and buoyant, and it drifts in the sea, uninjured, from tropical beach to beach.

Even birds and animals are compelled to act as seed carriers. Grasping hairs, barbed and sharp and hooked spines, fasten seeds to their coats "like burrs," or are trodden upon, and often are carried for long distances before the annoyed beast can rid itself of them. Mud dried on the shanks of water-fowl has its quota of small seeds.

It is to attract hungry creatures, especially birds, that seeds are often sunk in the flesh of luscious gaily

colored fruits. Sometimes this is so sticky that the seeds are smeared on beaks to be wiped off and planted far away, as in the mistletoe; sometimes the seeds, as in the case of cherry pits, have coats so hard as to pass through the creature's digestive organs uninjured. On the other hand, these plant friends must be kept from attacking the young seeds and carrying them off before the proper time. This is done by many effective devices. The unripe flesh of edible fruits, for example, is too green and hard or sour to tempt; the thick husks of walnuts are filled with tannin; citrus fruits bear burning oils in their skins. Other fruits, or the bracts inclosing them, are armed with sharp prickles and spines, as we are painfully aware when we handle a chestnut-burr or a thistle-head. Moreover, the food provided within the seed for the infant plant is often rendered unpalatable by bitter and curious flavors, some of which we have come to like, as those of chocolate and coffee. Nutritious starches and useful oils and drugs are found there also, and even poisons. We must never forget that the little seeds of the spiked thorn-apple can kill.

To get an idea of how a seed is constructed, remove the coat from a bean or a pea. At once you will notice that the "embryo" or young plant within has two main parts which you can easily separate. These are called seed-leaves or "cotyledons," and their purpose is to provide nourishment for the young plant when it first emerges from its seed-coat and before it has had time to unfold its leaves and push its roots into the soil to secure its own food. Besides the cotyledons the embryo has other smaller parts which will develop into the roots, stems, and leaves of the mature plant. In some plants the cotyledons are too small to provide much nourishment to the young seedling. In those cases nourishment is furnished by the "endosperm," a starchy tissue which surrounds the embryo. Beans have no endosperm, but corn seeds show endosperm as well as embryo. If you examine a kernel of corn you will also be able to see that the little corn embryo has only one cotyledon instead of two. This difference is so important that botanists classify all plants with inclosed seeds (angiosperms) according to the way their seeds are made. Those with two or more seed-leaves are called "dicotyledons"; those with only one are known as "monocotyledons."

Difference between Seeds and Spores

Only the true flowering plants, the "spermatophytes," produce seeds. Most of the so-called "flowerless plants" or "cryptogams" reproduce by means of spores, which are merely little cells set apart for reproductive purposes. Unlike seeds, spores do not contain any young plant or embryo. In earlier days it was a favorite joke to send youngsters on Midsummer-Night's Eve to hunt for fern-seeds, by telling them that if the lucky finder put them in his shoe he would become invisible—as invisible as the elders thought the seed was, for they did not know that spores, hidden in the brown patches, or *sori* on the back of the frond, take the place of seeds. One type of spore, formed by the splitting of a cell in the parent plant, is called "asexual" and is borne in sporangia. The other type includes "zygospores" and "oospores" formed by the union of two sexual cells, in the latter case dissimilar and known as male and female cells, but having also many other names according to their origin and family, as well as many shapes. Some of the male cells can swim by means of hairlike tails, or "cilia," which thrash about. When an asexual spore from a fern germinates, it spreads into a thin green sheet, called a "prothallium." On these prothallia arise small structures, flask-shaped, known as "archegonia," in which lie the female or egg cells, which are to be fertilized by the ciliated male cells escaping from other receptacles called "antheridia," carried by drops of rainwater. The fern plant which we know springs from the fertilized egg-cell and itself raises asexual spores. This roundabout process is called the "alternation of generations" and is followed by other cryptogams as well. (*See* Ferns; Fungi; Liverworts; Moss.)

SEINE (*sān*) **RIVER.** Foremost in historic interest of the rivers of France is the Seine, made world famous through the development of Paris on its banks. It rises from six little springs in a wooded rocky dale among the hills of the old duchy of Burgundy in eastern France and, after winding and twisting its way northwestward through a course of 482 miles, falls into the English Channel between the ports of Honfleur and Havre. In a direct line the source of the Seine is only 250 miles from its mouth, but the river doubles back and forth, curving and recurving upon itself until it consumes almost twice that distance. Gliding beneath the shade of overarching willows and tall poplars, it flows through a beautiful country rich in memories of bygone times, and abounding in relics of present and departed greatness. Battlegrounds of the Romans, the Vikings, and the Normans, ancient palaces of kings, grim feudal castles and medieval monasteries, intermingled with stately mansions of today and widespreading forests, lie along its course. Before reaching Paris about 230 miles from the mouth, it passes such famous cities as Melun and Fontainebleau, while below the great metropolis St. Denis, St. Germaine, and Rouen are situated on its banks.

The Seine near its source is a puny rivulet that sometimes in summer becomes quite dry. Sustained by small tributaries, however, it increases to a vigorous brook, and farther on, as it receives in turn the waters of the Aube, the Yonne, the Oise, and the Marne, it develops into one of the four important rivers of France, furnishing water-power for numerous large industries. It is navigable for small vessels for some distance above Paris. The low elevation of the hills which bound its basin makes it comparatively easy, moreover, to connect the Seine and its tributaries, by means of canals, with the Somme,

the Scheldt, the Meuse, the Saône, and the Loire. Deep dredging from its mouth to Rouen, a distance of about 50 miles, has made that city a seaport and has reclaimed 28,000 acres of land.

SELENIUM. "If anyone were to strike a match on the moon, we could probably discover the fact on earth by means of selenium." This statement was made by an enthusiastic scientist a few years ago; and while it may be an exaggeration, it suggests dramatically selenium's peculiar powers.

This comparatively rare element was first isolated by Berzelius, famous Swedish chemist, in 1817. Its photosensitivity was not discovered, however, until half a century later.

In the dark, selenium is a poor conductor of electricity. But let a beam of light strike it and its conductivity instantaneously increases in direct proportion to the light's intensity. Inclosed in a suitable cell to shut out other influences and connected in an electrical circuit with a galvanometer, a thin film of selenium becomes, therefore, a device for measuring the brightness of any light that passes through the cell window. Furthermore, it enables us to translate variations of light into variations of electric current, which can in turn be translated into sound by telephonic methods.

After he invented the telephone, Bell experimented with the "photophone," in which the voice made a beam of light vibrate over a distant selenium cell receiver. The "optophone" and "phonopticon" are selenium devices to help blind people to read. They "hear" the light variations coming from the letters.

Selenium cells have been used to measure sunlight, moonlight, and the feeble rays from stars beyond our ordinary vision; to control traffic lamps and to turn harbor beacons on at night and off at dawn; and to transmit pictures by wire and radio. In recent years, however, their place has been largely taken by photoelectric cells because the latter are usually more rapid in their response to light changes (*see* Photoelectric Devices). The chemical properties of selenium are useful in controlling the color of glass. In small quantities it yields a pink tinge that counteracts the green from iron impurities. In larger quantities it produces the kind of red glass used in automobile taillights. Some enamels and pigments are made with selenium compounds. Most of the world's selenium is a by-product of copper refining.

SENSATION AND PERCEPTION. If we look into the clear sky, we see a blue color; when a piano key is struck, we hear a tone; when we eat sugar, we taste sweetness; when we hold ice in the hand, we feel coldness. Seeing blue, hearing a tone, tasting sweetness, and feeling coldness are examples of sensations.

Usually we experience a number of sensations all at one time. An apple, for instance, has color, form, odor, and weight. When we examine an apple, we do not experience separate sensations of color, form, odor, and weight. Instead these different sensations combine to make us aware of the apple as a whole.

Sensations are not learned but arise when a sense organ such as the eye, ear, or skin, is stimulated. Most sensations can be experienced at birth or shortly after. Although a baby does not learn to smell or see, he learns to know the meaning of what he smells or sees. If a lighted candle is held before a young infant, he sees a bright spot, but does not see a candle as we do. To see and recognize a candle as a candle is an example of perception and not merely sensation. The first time the child gets a particular sense stimulation, he experiences a *sensation;* but when the stimulation is repeated, he recognizes or knows the object, and so experiences *perception.* For all except very young infants, therefore, sensation is really perception, that is, sensation with the addition of images and memories from earlier experience.

A sensation is always a reaction brought about by some particular stimulus affecting a sense organ, or receptor, located in some part of the body. Altogether 11 different senses, each with its own specialized set of receptors, are known. These are: (1) sight from receptors in the eyes; (2) hearing from receptors in the ears; (3) smell from receptors in the nose; (4) taste from the tongue; (5) touch from the skin; (6) warmth from the skin; (7) cold from the skin; (8) sensations of hunger and fatigue from receptors in the internal organs; (9) pain from receptors in most parts of the body; (10) sensations of movement and strain from the muscles; (11) sensations of rotation and position from receptors in the semi-circular canals, the utricule, and the saccule of the ears.

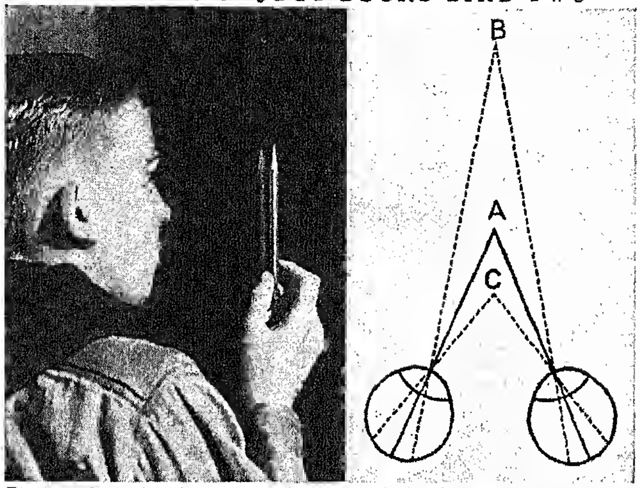
When a receptor is stimulated a message, called an impulse, travels over a nerve fiber to the brain. The activity in the brain, caused by the impulse from the receptor, results in a sensation. (*See* Brain.) As each receptor is specialized so that it receives only a certain kind of stimulation, the receptors are not aroused to activity by all the objects that come in contact with them. The eye is not affected by sound, and similarly the ear is not stimulated by odors. Sometimes, however, we obtain special sensations when receptors transmit messages for which they are not especially adapted. For instance, if a person bumps his head severely his eyes are jarred enough to stimulate the receptors of vision. These respond with their own kind of sensation, and we "see stars." Sometimes our receptors make a mistake and consequently we attach the wrong meaning to sensations. This misinterpretation is called an illusion (*see* Illusions). Only a few different sensations can be aroused through the receptors located in the skin, tongue, or muscles, but hundreds may be sensed by the nose, the eyes, or the ears. Our organs of taste can respond to only four types of chemical substances—sweet, bitter, sour, and salty. Our visual organs are sensitive to more than half a million different stimuli.

Regardless of their type, sensations differ from one another in intensity. If you press a piano key lightly a faint tone is heard. If the same key is struck forcibly a loud tone results. One light may be brighter

or fainter than another, or a pail may be lighter or heavier than some other pail.

Suppose you have one pail with enough sand inside to weigh 100 ounces, and a second which weighs 101 ounces. If you lift one pail and then the other you will be unable to determine which is the heavier. Now place another ounce of sand with the 101 ounces; still you cannot tell the 102-ounce pail from the lighter one. Similarly you will be unable to detect any difference between 100 and either 103 or 104 ounces. But when you compare 105 ounces, you will be able to distinguish a just noticeable difference. This shows that the intensity of any stimulus must be increased by a certain fraction of itself in order to produce in us a noticeably different sensation. A weight must be increased by $\frac{1}{20}$ of itself, a noise must be $\frac{1}{5}$ stronger, and a light $\frac{1}{100}$ more intense, to be noticed as different by the normal person. The minimum intensity of a stimulus that can be detected by the senses is called the *threshold of sensation.*

WHEN ONE OBJECT LOOKS LIKE TWO

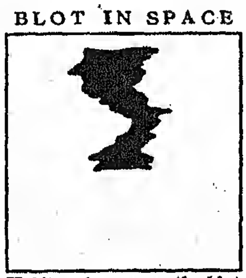


The boy above, keeping his eyes focused on Point A, sees a double image of the pencil held at either Point B or Point C because the images do not fall on corresponding portions of the two retinas. An image on the right half of either retina makes the object appear to the left, and vice versa.

We not only perceive objects as objects but we also see them in a world of space. Tack a sheet of paper on the wall. You can see readily that it has two dimensions, height and width. But when you look at a box you know that it has the third dimension of depth in addition to height and width. Also you can tell when one object is nearer than another. A combination of several elements or clues is involved in our perception of depth and distance. The most important of these clues may be described as follows:

1. When we look at objects at different distances, the lens in the eye changes its shape through the action of muscles within the eye. As the movement of these muscles produces a different feeling when we are looking at near objects or far objects, we are able to judge how far away the object is.

BLOT IN SPACE



Habit makes us see the blot standing out as a definite object against the background of white space.

2. When we look at objects near us, the eyes turn in toward the nose; when the object is far away they are parallel. This helps us tell how far away an object is.

3. In normal vision our eyes are focused so that the image of the object we are looking at falls on corresponding points on the two retinas, and a sense impression of a single object is produced. This is called *binocular vision.* Now hold your first finger and a pencil upright, lined up directly in front of your nose, the finger about 20 inches and the pencil 8 inches from the face. Look steadily at the far object, the finger, and at the same time note the appearance of the near object, the pencil. Two pencils will be seen; this effect is called "double images." Continue looking at the finger and close one eye and then open it. One image of the pencil will disappear and then return. If you look steadily at the pencil you will get two images of the finger. Usually when we look at one part of any object, all parts of the object, nearer or farther away than the place where we are looking, appear as double images. Without our noticing them, these double images are important aids in perceiving depth or distance.

4. Because of the dust and moisture particles in the air, objects at a distance are not as distinct as those near by. When outlines are sharp and details clear, objects seem near. High in the Rocky Mountains, where the air is very clear, a mountain peak 40 to 50 miles distant seems only a few minutes' walk away. The clear outlines trick us into perceiving it as near at hand.

5. Suppose we look across the street at a house which has trees on the lawn and a car parked in front of the trees. The car covers from our view part of the tree trunks, and the trees conceal part of the house. We see the trees as nearer than the house they cut off from sight, and the car as nearer than the trees. This covering of parts of objects by others is a further aid in judging distance.

6. If you keep your eyes fixed on some object some distance away, and move your head to the right, objects between you and the one looked at will appear to move to the left. But objects beyond the one looked at will move only a little; but those farther away will move more. These displacements help to show the relative distances of objects from your eyes. The little child cannot, of course, perceive distances by these clues. We have to learn to use these aids; and it is through repeated experience in judging distances that we do it correctly.

Seeing things right side up is also something we have to learn. The human eye is like a camera. When

we look at an object, its image, as in any camera, is "printed" upside down on the retina. Our daily experience, however, has made us accustomed to the order of things and taught us to see objects as right side up. To prove this, a man wore for seven days a special pair of glasses which turned all pictures or images so they were right side up on the retina. At first everything looked upside down. His own right hand seemed to be on his left side. When he reached for a thing to his right, he extended his hand to the left. In a few days, however, everything appeared right side up again. But when he took his glasses off at the end of seven days, objects again seemed upside down for a time.

There are other important characteristics of visual perception. We have a tendency to see continuous movement, even where there is no movement, as in electric signs. This is called "apparent movement." On electric signs a bulb is lighted, then an instant later another, then a third, and so on. The stream of lighted lamps appears to move in the direction of the new bulbs that are being lighted. At night the warning lights at railroad crossings show a similar apparent movement as the two red lights, which are mounted side by side, are lighted and turned out one after the other.

What makes the "movies" move? A series of still pictures is flashed quickly, one after another, on the screen. The positions of people or other objects are slightly different in each picture. Because it is natural, and is also easier to see movement than a series of still views presented quickly one after another, the pictures appear to move.

Suppose we draw a square about two inches on a side, and then place in the center of this an irregular shaped ink blot. Now look at the drawing. The small blot will stand out as a definite object against the background of the remaining inclosed space. The ground seems like indefinite space, and looks as if it extended around behind the figure. In nearly all our perceptions we see some object or figure against a general and somewhat uniform background.

One final characteristic of perception should be considered. Let someone place a small handful of marbles into a shoe box. Take a single peep into the box and then look away at once. Now try to tell how many marbles you saw. You will have no difficulty if there are only three or four. When there are five or six marbles you will answer correctly most of the time. If there are eight or nine, however, you will make many mistakes. With 15 or 20 marbles in the box it is easy to see them all, but you cannot tell how many there are. This shows that we can ordinarily perceive or apprehend only four or five things at once. If there are different objects in the box, as a knife, a marble, a pencil, and various other objects, we could name only three or four correctly, for it is harder to name things than merely to tell how many objects are present. (*See* Ear; Eye; Skin; Taste; Tongue; Touch.)

SENSITIVE PLANTS. All plants are more or less sensitive, that is, able to respond to stimuli. Some plants, however, respond so quickly and so evidently that they have been popularly called sensitive plants. Conspicuous among them are species of mimosa, acacia, and their allies, members of the pea family. These plants have large compound leaves composed of numerous and very small leaflets. At a sudden touch the paired leaflets fold together, or the whole leaf may fold up and its petiole droop. In the natural surroundings of these plants this folding of the leaves has to do with the avoidance of too intense light or drouth, the surface of exposure thus being diminished in exact proportion to the need. (*See* Compass Plants; Plant Life.)

SENTENCE. A sentence is a group of words expressing a complete thought. We use sentences almost every hour of every day. But a speaker or writer who makes a sentence must have something to think about, and he must single out some fact concerning it which interests him especially, and assert that fact or ask a question about it. For example, suppose he is thinking about water. If he is going in bathing he is especially interested in its temperature, so he asserts, perhaps, "The water is cold." Or he may put his thought in the form of a question: "Is the water cold?" Under other circumstances he might think of the color, and exclaim: "How blue the water is today!"

Now, the part of the sentence that represents what is talked about is called the *subject*. All the rest of the sentence, which asserts or *predicates* something, is called the *predicate*. In all the sentences above, the words *the water* are the subject.

The complete subject of the sentence always contains a noun or a pronoun, or a group of words used like a noun, which stands for the thing talked about. This is called the *subject substantive*. It may or may not have adjuncts or modifiers. In the sentence "People who live in glass houses mustn't throw stones," the word *people* is the subject substantive. It has as a modifier the clause *who live in glass houses*, showing which people are meant. The *complete* subject is the words "*people who live in glass houses.*"

That Much-Needed Verb

The predicate of a sentence must always contain a verb (*see* Verb). Sometimes this verb by itself says all we want to say about the subject; as "The water *boils*." But often we want to add to the meaning of the verb, to make it clearer and more definite; as "Water *boils more rapidly if you make the fire hotter*." And again, certain verbs require other words to complete their meaning. Linking verbs, such as *be*, *become*, take a *predicate* noun, pronoun, or adjective to complete their meaning. Transitive verbs, that is, those that express an action as affecting someone or something other than the subject, must have an *object*. This object may be one word or a group of words; as, "The water burned *me*"; "He said *that the water was cold*."

Any or all of these necessary or essential elements of the sentence may be made more clear and interesting by the use of modifiers or adjuncts added to them; as, "The water *in the large kettle* is *not* boiling *yet, though the fire is hot*"; "The water *in our pond* is *still too cold for comfortable bathing.*"

These modifiers are either single words, phrases, or clauses. A *phrase* is a group of words not consisting of a subject and predicate, and used like an adjective, an adverb, or a noun; as, *under the tree, finding gold at the rainbow's end, to stay here.* A *clause* is a group of words consisting of a subject and predicate, combined with another such group to make a single sentence. For example, "I came, I saw, I conquered" is a sentence consisting of three clauses, each of which might stand by itself as a single complete sentence.

The Part the Clauses Play

Clauses which are of principal and equal importance in the sentence are called *coördinate* clauses. Clauses which are dependent on some other member of the sentence are called *subordinate.* Subordinate clauses may be used like adverbs, to define the meaning of the principal verb ("I shall come *when I am ready*"); like adjectives, to define the meaning of a noun or pronoun ("This is the house *that Jack built*"); or like nouns ("He told me *what I wanted to know*").

According to form, sentences are *simple, compound,* or *complex.* A *simple* sentence is a sentence that consists of one proposition. Either its subject or its predicate or both may be compound, as: "*Bread* (and) *potatoes* are starchy foods"; People *need certain food elements* (and) *usually enjoy the proper combinations of these*"; *Both men (and) animals require abundant fresh air* (and) *weaken in confinement.*"

A compound sentence is a sentence that consists of two or more independent propositions or clauses, as: "I came, I saw, I conquered." Propositions should not be joined in a compound sentence unless they are closely related in thought. "John is captain of our baseball team, and the North Pole has been discovered," though from one point of view correct grammatically, is not a real sentence, since it is not the expression of a single thought. The members or parts composing a compound sentence are usually joined by a coördinating word called a conjunction (*see* Conjunction).

A *complex* sentence is a sentence consisting of a main proposition or clause and one or more subordinate clauses; as, "Wait *till he comes.*" "Between the dark and the daylight, *when the night is beginning to lower,* comes a pause in the day's occupations, *which is known as the children's hour.*"

Now in nearly all the sentences we have talked about so far, the predicate states or *declares* something about the subject. For that reason we call such sentences *declarative* sentences. But there are also three other kinds of sentences, distinguished according to meaning. There is the kind that asks a question; as, "Is Buenos Aires the largest city of South America?" These question-asking sentences are called *interrogative* and always end with a question mark (?). Another kind of sentence commands someone to do something; as "Everybody come in!" We call this sort of sentence *imperative,* and often put an exclamation point (!) after it. Then there is a fourth kind of sentence that we use when we want to express strong feeling about something. For example, if you are surprised to wake up in the morning and see a heavy fall of snow you exclaim, "What a lot of snow has fallen!" Such a sentence is called *exclamatory,* and always has an exclamation point after it.

Some very common mistakes in writing are due to vague notions about the difference between a sentence and a clause or phrase. Two or more separate sentences are often incorrectly written as if they were one sentence; as, "The trees by the pond are bare now, they are maples and willows." And, on the other hand, uneducated persons will sometimes treat a part of a sentence as if it were a sentence by itself; as, "He was well satisfied with the returns in health and good fellowship. Though he lost money by the undertaking."

SEPTEMBER. The name of this month comes from the Latin word meaning seven, and it was the seventh month of the Roman calendar (beginning with March). September is the ninth month according to our reckoning. It has always had 30 days. It is preëminently the harvest month, and in it occurs the autumnal equinox (*see* Equinox and Solstice).

SEQUOI'A. No work of nature is more majestic or more awe-inspiring in its way than the gigantic evergreen sequoia trees of California, the largest and perhaps the oldest of all forest trees. They are of two species, the "big trees," or Washington sequoia, found only on the western slopes of the Sierra Nevada range, whose massive grandeur brings to them thousands of visitors each year, and the redwoods of the Coast Range, which furnish one of the most valuable timbers of the Pacific coast.

Groves of the "big trees," the last survivors of a very ancient and very wonderful family, are carefully preserved in state and national parks. One author says of them: "In stature they are imposing as no other living thing; in age they are a measure for the centuries; in situation they are stranded on the flanks of a mountain range where they are able neither to retreat nor to advance." These giants average 275 feet in height and 20 feet in diameter; some are 320 feet high, 25 to 35 feet in diameter. The fluted, bright cinnamon-colored trunk often rises branchless to a height of 180 feet. The fire-resistant bark protects them from forest fires. The crown is narrow and dome-shaped, clothed in long sharp-pointed evergreen foliage, from which hang small scaly reddish-brown cones. The tops of the very old trees are much broken from the weight of snow and windstorms. From the annual rings in the wood the age of the largest trees yet felled has been placed at

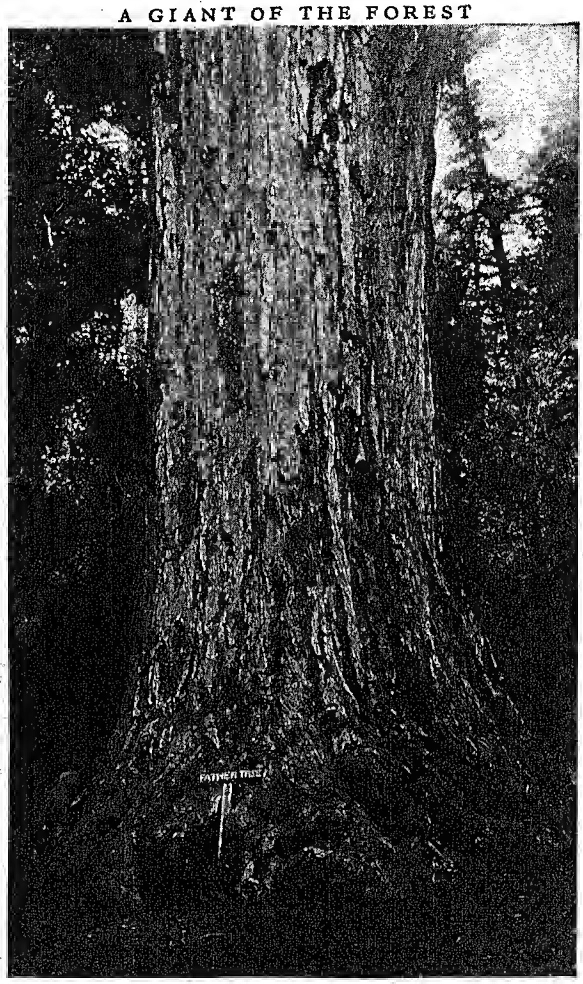
more than 3,000 years. Authorities estimate that some of the giants still surviving may be 3,500 or 4,000 years old.

One of the most famous big trees is the Grizzly Giant, in Mariposa Grove, adjoining the Yosemite Valley. At the ground it is 93 feet in circumference. Its royal crown has been shattered and its body stripped nearly bare by the centuries of storms through which it has passed. Another mighty tree has a tunnel in its base through which motor stages drive. Within the fallen trunk of another in the Calaveras Grove near Stockton is a passage big enough for a man on horseback. You may get some idea of the enormous amount of timber contained in one of these giants from the fact that the trunk of the General Sherman Tree alone would furnish more than a half-million board feet of lumber, enough to build 100 five-room houses.

The dark red wood of the "big trees" is light and extraordinarily durable, and in the past thousands of these trees were cut for lumber. But since they have come under the protection of the state and nation, their commercial use has been limited.

It is therefore left to the redwood trees, which are much more plentiful, to supply most of the sequoia tribe's contribution of timber. The redwoods thrive only in the fog-drenched forests of the coast. Their reddish-brown foliage lies in flat sprays, and the cones are borne in clusters, usually in the tops of the trees. Unlike the "big trees," which reproduce exclusively from cones, the redwoods reproduce also by sending up suckers to form new trees. On many redwood trees there are round, wart-like burls, formed probably by closely crowded buds which continue to grow, but rarely send out shoots. These burls have a handsome bird's-eye grain, and are used commercially for veneers and for souvenir articles. Small burls are often used as house plants. Redwood lumber is light, straight-grained, and easily worked, and when correctly dried it does not shrink or warp. It is slow to burn, for it contains no resin. It resists insects and decay almost indefinitely, even when it is in contact with soil or water. Hence it is used for fence posts, telegraph poles, railway ties, paving blocks, bridges, piers, tanks, and water-supply conduits. In house-building, redwood is used for foundations, siding, shingles, and trim.

A GIANT OF THE FOREST



This is an old "Sequoia Gigantea," with a diameter of 26 feet. The bark of the tree is spongy and deeply wrinkled, and often as much as two feet thick. The trunk tapers very gradually and usually has no branches within 100 feet of the ground. The Giant Sequoia is native only to California.

The name "sequoia" was given these trees in honor of Chief Sequoyah, a Cherokee Indian, who in 1821 invented a phonetic alphabet which was so simple that Cherokee children learned to read and write the language in only a few days.

Scientific name of "big tree," *Sequoia gigantea*, or *Sequoia washingtoniana*. Bark 1 to 2 feet thick. Leaves awl-shaped, 1/8 to 1/2 inch long. Cones 2 to 3 inches long. Scientific name of redwood, *Sequoia sempervirens*. Height 100 to 340 feet, trunk 2 to 16 feet in diameter, bark reddish brown, 4 to 12 inches thick. Leaves 1/4 to 3/4 inch long. Cones 1/2 inch to 1 1/8 inches long. Branches horizontal or drooping.

SERBIA. In the 14th century Serbia was mistress of the greater part of the Balkan peninsula from the Danube to the Gulf of Corinth. A century later she was the vassal of the Turk, and her people were sold as slaves in the markets of Constantinople. In the 19th century she was freed from Turkish rule and grew in economic and political strength; and in the Balkan Wars of 1912–13—the first fought against Turkey and the second against Bulgaria, her former ally—she just about doubled her territory. Her people cherished dreams of restoring the "Greater Serbia" of their golden age; but up to the outbreak of the great World War of 1914–18, Serbia remained a peasant kingdom of small farmers. Though ravaged by Austrians and Bulgarians in the war, the Serbians held out courageously to the end. They were rewarded by the reunion of the whole South Slav race in the "Kingdom of the Serbs, Croats, and Slovenes," now called Yugoslavia. (*See* Yugoslavia.)

The Serbians, like all mountaineers, are fierce fighters in war, but they are kind and hospitable in peace. In normal times, the first farmer you meet will offer you a seat in his ox-drawn cart and is glad to share with you the shelter of his home and the simple fare of his table. The mother of the household will put before you the corn cakes which are eaten three times a day, and bring out her delicious plum marmalade. The Serbians make and export this marmalade. Plum orchards flourish in Serbia and are to the people there what apple orchards are to us.

In the more primitive regions are still found "zadrugas," or community groups of families related to one another, living in separate cottages but having a large building in common in which they eat and spend the evenings.

The little farms of today seldom exceed 20 acres. A Serbian farmer cannot lose all his possessions under a mortgage as an American farmer can because the law will not allow him to give, or another to take, a mortgage covering more than a certain proportion of his land. His cottage he cannot mortgage at all—nor his garden, his plow, or the cattle necessary to draw the plow or haul his products to market.

There are no very rich people, neither are there any very poor ones. There are practically no paupers and there are no poorhouses. The people are not so thrifty nor so industrious as the Bulgars, nor so clever as the Rumanians. Comparatively few are engaged in manufactures, for the Serbian feels that he forfeits his independence by working in a factory. There are some meat-packing plants, flour mills, breweries, iron foundries, potteries, sugar, tobacco, and celluloid factories, and mills for weaving hemp, flax, and wool, but the workers are mainly foreigners. There are a few home industries including spinning, the making of corded sandals such as peasants wear, and handwoven carpets and rugs. They also export native wines, mainly to France and Switzerland. For years the most serious drawback to the commercial development of Serbia was the lack of seaports, which placed the country at the mercy of hostile tariffs. In the new Yugoslavia this was remedied.

The area of Serbia is about 36,940 square miles, and the population about 4,150,000. Besides Belgrade, the capital, important cities are Nish, Prisrend, Uskup, and Monastir, or Bitolj. The Serbian religion is the Greek Catholic. The Cyrillic alphabet, used formerly, is being replaced by Latin in the schools.

The Serbians first settled in their land in the 7th century. The Turkish rule began with the defeat of the Serbians in the great battle of Kosovo in 1389, and was maintained with such cruelty that many Serbs emigrated to southern Hungary. After more than four centuries of tyranny, a group of Serbian patriots organized a rebellion and elected George Petrovitch (called Kara-George or Black George) as their leader (1804). They recovered the district about Belgrade, but were soon forced to flee from the Turkish forces sent against them. In 1815 a second rebellion was organized by Milosh Obrenovitch, who succeeded in establishing the autonomy of the Belgrade government (1829) and proclaimed himself hereditary prince. When Kara-George returned to Serbia he was assassinated by Milosh's orders. The next half-century was spent in feuds between the rival houses of Kara-Georgevitch and Obrenovitch, and attempts to free more Serbian territory from the Turks. The long struggle ended in 1878, when, following the Russo-Turkish War, complete independence was conferred upon Serbia by the Congress of Berlin.

Unfortunately Serbia blocked the "corridor" by which Austria-Hungary hoped to reach the Aegean and dominate the Balkans. This precipitated the Austrian ultimatum of July 23, 1914, which led to the first World War. (*See* World War of 1914–1918.) Prince Alexander was then regent for his ailing father King Peter I. Peter had come to the throne in 1903 after conspirators murdered Alexander I and Queen Draga. When Serbia joined in forming the new state of Yugoslavia in November 1918, Peter became its king and Alexander its regent (*see* Yugoslavia).

The "SEVEN WONDERS" *of* ANTIQUITY *and of* TODAY

Man's Triumphs as a Builder—The Pyramids, Sole Survivors of the Mighty Seven—Babylon's Hanging Gardens, Olympian Zeus, Diana's Temple at Ephesus, the Mausoleum, the Rhodes Colossus, and the Pharos Light

SEVEN WONDERS OF THE WORLD. Of the marvelous works built in ancient times the sightseers of the time of Alexander the Great selected seven as the most wonderful. These were variously listed, but a list found in a little treatise of about the 6th century A.D. gives the following: (1) the Pyramids of Egypt; (2) the Hanging Gardens of Babylon; (3) the Statue of Zeus at Olympia; (4) the Temple of Diana at Ephesus; (5) the Mausoleum at Halicarnassus; (6) the Colossus at Rhodes; (7) the Pharos (lighthouse) at Alexandria. The world has learned much about engineering and architecture, but we still marvel at the massive Pyramids, which stand as solid as ever after the wear and tear of centuries (*see* Pyramids). Except for fragments of the Mausoleum and the Temple of Diana, they are the only "wonder of the world" that remains today.

The Hanging Gardens of Babylon have long since disappeared. They were said to have been built by King Nebuchadnezzar (about 660 B.C.) to please his favorite wife, who had come from a hilly land and wearied of the flat plains of Babylon. Great terraces of masonry, from 75 to 300 feet in height, were built one on top of the other, and on these were planted

gardens of gorgeous tropical flowers and groves and avenues of palm trees, irrigated by water pumped from the Euphrates River. On these "roof gardens" Nebuchadnezzar and his queen could sit in the cool shade and look down upon the beauties of the city.

The Statue of Olympian Zeus was erected at Olympia, in the Peloponnesus of Greece, by the great sculptor Phidias, in the 5th century B.C. It was a towering structure of ivory and gold, 60 feet high, no less remarkable for its majesty and beauty than for its richness and size. It has utterly perished, and our only idea of it is gained from coins of Elis which are said to bear copies of the great original. (*See* Phidias; Zeus.)

Recent excavations on the site of the ancient Greek city of Ephesus, in Asia Minor, have revealed fragments of the pavements, columns, and sculptures of the magnificent Temple of Diana. Their workmanship is so superb that it is easy to see why the ancients regarded the temple as one of the wonders of the world. The first Greek settlers at Ephesus found the Asiatic inhabitants worshiping a many-breasted nature goddess, whom they identified with their own Artemis (called Diana by the Romans). They raised a shrine to her, which was rebuilt and enlarged from time to time. The fourth temple is the one regarded as the "Wonder." It is said to have been built by contributions from all the great cities of Asia and to have taken 120 years to complete, being dedicated about 430 B.C. This great structure, alas! was set on fire in 356 B.C.—on the very night when Alexander the Great was born, it is said—by one Herostratus, who committed this crime merely that his name might be remembered in after ages!

A new temple of Artemis was completed before the end of the century, and it stood until 262 A.D., when it was sacked and burned by the Goths. The great sculptured drums of the lower part of its 60-foot columns, now in the British Museum, indicate that the fifth temple was inferior in workmanship to the fourth. Both were embellished with priceless statues and paintings. They were among the largest Greek temples ever built, the fourth measuring 425 feet by 220—which is larger than St. Peter's in Rome, the largest of all Christian churches. The fifth temple was still larger. After the edict of Theodosius (381 A.D.) which closed the pagan temples, the ruins of these ancient structures were used as materials for the construction of Christian churches. Two of the pillars in the great cathedral of Pisa, and the green jasper columns supporting the dome of St. Sophia's in Constantinople, are said to have been taken from the Temple of Diana.

Famous Tomb of King Mausolus

The Mausoleum at Halicarnassus—also in Asia Minor—derived its name from King Mausolus of Caria, who died about the middle of the 3d century B.C. His wife, who was devoted to his memory, employed Greek architects and sculptors to construct and decorate, at Halicarnassus, this superb monument over his remains. It was a great rectangular pile of masonry, surmounted by an Ionic colonnade which supported a roof-like pyramid. At the apex of this pyramid stood a magnificent four-horse chariot, in which were statues of the king and queen. So famous did it become that the word "mausoleum" is now applied to any monumental tomb. Some of the remains of the original Mausoleum are now preserved in the British Museum.

The Colossus of Rhodes was a great bronze statue, probably 105 feet high, of the sun god Helios, the god of the Rhodians, or of Apollo. Erected in 280 B.C., legend had it that the giant work stood astride the entrance to the harbor of Rhodes, an island in the Aegean Sea, but more probably it stood at one side of the entrance. It was overthrown by an earthquake in 224 B.C., but long remained, even in fragments, an object of wonder. Nearly a thousand years after it had fallen, in 656 A.D., a Saracen dealer bought it and carried away the fragments as old metal.

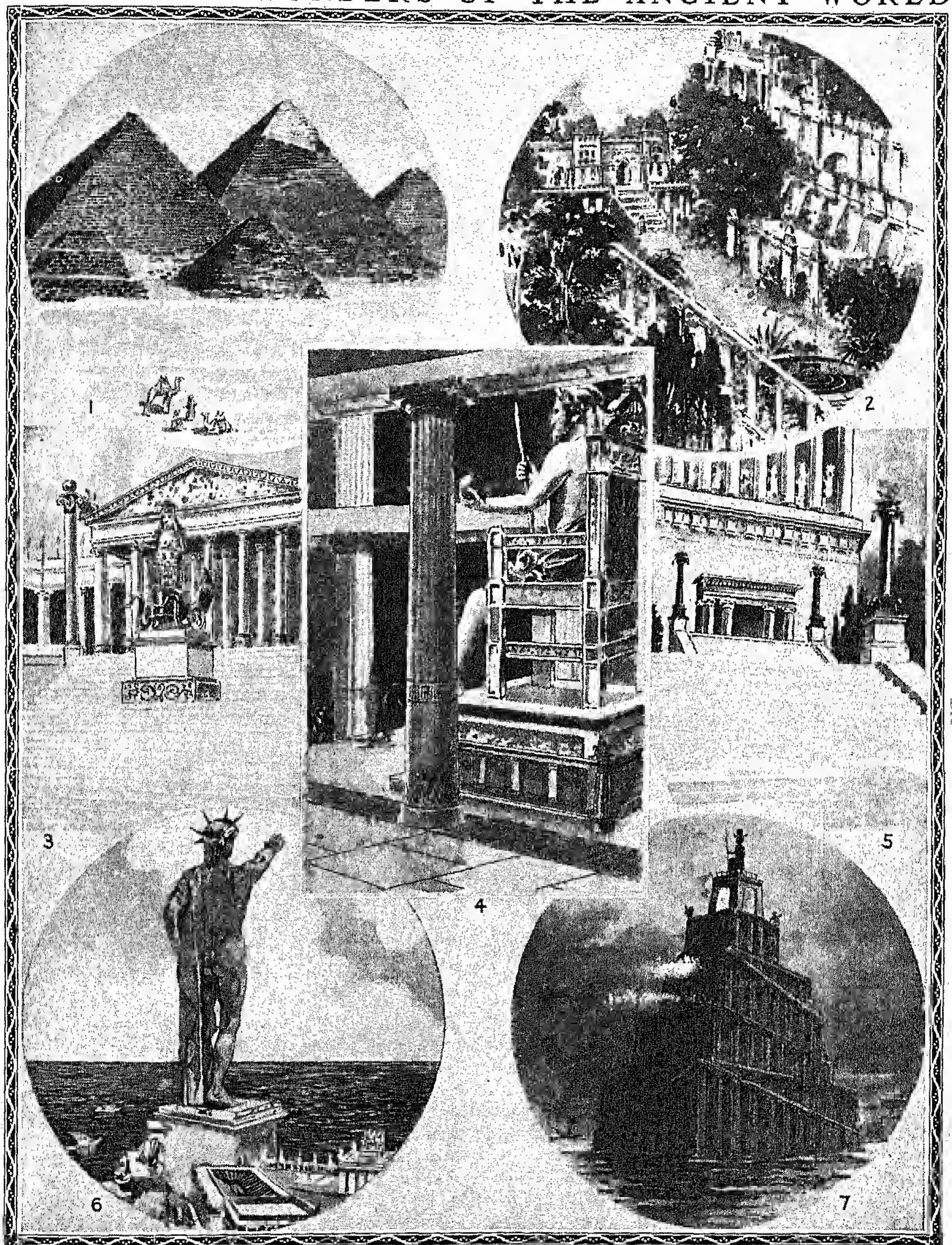
The Pharos of Alexandria, in Egypt, was the forerunner of modern lighthouses. The name belonged originally to an island lying off the coast. When Alexander the Great laid out this city to which he gave his name, he connected the island of Pharos with the mainland by means of a "mole" or causeway. On the eastern point of the island Ptolemy I and Ptolemy II, Greek kings of Egypt who followed him, erected a great lighthouse of white marble, said to have been 400 feet high; and it was this structure which came to be known as "the Pharos of Alexandria."

But What were Those Days to Ours?

Amazing as were these wonders of the ancient world, they pale before the wonders of modern times. The Pyramids, mighty as they are, are equaled by such structures as the locks of the Panama Canal and the great dam at Assuan, which England built to store the waters of the Nile. The Hanging Gardens of Babylon, the Mausoleum, the Ephesian temple, and the Pharos sink into insignificance before the skyscrapers and public buildings of to-day.

But the real "wonders" of today are the amazing and beneficent triumphs of modern scientists over Nature, — their discoveries and inventions which enable man to fly like the birds, to talk thousands of miles without wires, to baffle disease, and perform every day and every hour feats which exceed the wildest imaginings of the ancients. So we may list as the "Seven Wonders" of the modern world its seven greatest scientific achievements. Some time ago an American magazine took a vote of its readers as to what these seven modern wonders are. Here is the list that was chosen by the vote: (1) Radio, (2) the Telephone, (3) the Airplane, (4) Radium, (5) Anesthetics and Antitoxins, (6) Spectrum Analysis, and (7) X-rays. If you will turn to the articles which deal with these subjects, and let your mind dwell on the marvels in each of these achievements, you will see that these modern "wonders" are no less wonderful than those of the ancient days.

THE SEVEN WONDERS OF THE ANCIENT WORLD



The only one of these marvels of antiquity that has survived to our own day is the Pyramids of Egypt (1). All the others have perished and the representations above are imaginative reconstructions based on the descriptions of ancient writers. 2. The Hanging Gardens of Babylon were built by Nebuchadnezzar to gratify one of his wives. 3. The Temple of Diana at Ephesus, one of the largest temples ever built, was a veritable treasure house. 4. The Statue of Zeus on Olympus was the masterwork of the sculptor Phidias; the figure was carved from ivory and the drapery was solid gold. 5. The Tomb of King Mausolus at Halicarnassus in Asia Minor. 6. The Colossus of Rhodes, about 100 feet high and built of brass, guarded the harbor of Rhodes. 7. The Pharos of Alexandria, a lighthouse 400 feet high. By day a huge mirror at the top reflected the sun's rays far out to sea.

SEVEN YEARS' WAR (1756–1763). When Frederick the Great of Prussia, in 1740, seized the Austrian province of Silesia, he, like the youth who murdered the Austrian archduke at Sarajevo in 1914, set off a powder mine that had been laid by the world-wide rivalries of European powers and alliances. The struggle spread from Austria and Prussia to all Europe, and finally burst over the whole world from the Indian rajahs of Hindustan to the European colonists of Canada and New England. For more than a score of years the quarrel disturbed the peace of Europe. In the War of the Austrian Succession (1740–1748)—called by Germans the first two "Silesian" wars—Maria Theresa, the courageous young ruler of Austria, made two vain attempts to recover her stolen lands (*see* Maria Theresa). There was next a breathing spell of eight years. Then in 1756, having won new support among the powers of Europe, she decided to try a third time; but before she and her allies could strike a blow, Frederick the Great, learning of their intentions, invaded the neutral but unfriendly land of Saxony, and so himself began the third Silesian or Seven Years' War.

Since the beginning of the quarrel over Silesia there had been a general shift in the relations of the nations of Europe. In the War of the Austrian Succession Great Britain had taken up arms on the side of Austria, while France had fought alongside Prussia. But when the conflict began in 1756 a "diplomatic revolution" had brought a reversal of alliances. With Prussia was now allied her old enemy, England; for William Pitt, who was now in control in England, saw more clearly than did the stupid George II, with his Hanoverian prejudices, that the second "hundred years' war" between France and England for colonies must be won in Europe. Kaunitz, a young minister of Maria Theresa, also looked at old questions with new eyes. He persuaded her to forget the old French (Bourbon) and Austrian (Hapsburg) rivalry extending over 250 years, and to seek aid in France against her real enemy, the rising power of Prussia. France—or rather Madame Pompadour, Louis XV's favorite—listened, hesitated, and then joined Austria.

The League of the Three Petticoats

On the one side there were Austria, Russia, and France—"the League of Three Petticoats" (Madame Pompadour, Maria Theresa, and Empress Elizabeth of Russia), as it was sneeringly called. On the other were Great Britain with its navy and Prussia with its well prepared army, plus Pitt's statesmanship and Frederick's military genius.

At the outbreak of the war Frederick made himself master of Saxony by the defeat of the Austrians, temporarily invaded Bohemia, and again inflicted defeat upon the Austrians (at Prague, May 1757). Later in the year he defeated the French and his German enemies in the most famous, perhaps, of his battles—at Rossbach. A month later (December 1757) he routed the Austrians at Leuthen. Through the varying fortunes of the two succeeding years, Frederick's military genius enabled him, despite desperate situations when he was ringed about by hostile Russian, French, Swedish, and Austrian armies on Prussian soil, with Berlin occupied and plundered, to wrest victories from his enemies and hold the balance even in Europe, while Pitt directed the forces of England to triumph in America and India. Then George III came to the English throne, in 1760. The genius of Pitt made him uncomfortable. The great minister was forced to resign in 1761, and shortly afterward the money subsidies which England had been paying to Frederick ceased. Frederick's straits were somewhat relieved in the following year, when Elizabeth of Russia died and Peter III, her successor, in his few months' reign made peace with Prussia. Sweden and France fell away from the alliance, and finally Austria, too weak to carry on the war alone, made peace with Prussia at Hubertsburg (Feb. 15, 1763). The map of Europe was not changed by this peace, for Silesia was confirmed as a possession of Frederick.

A War on Three Continents

The war, as has been said, was not confined to Europe. In America the conflict had begun the year before it broke out in Europe, and was known as the French and Indian War (*see* French and Indian War). Here the struggle went against France, and in the end she lost all of her American possessions.

In India English prowess met with like good fortune. The East India Company had founded settlements for trade, which gave promise of extending to an empire; but France, jealous of her hereditary rival, endeavored to snatch the prize. Dupleix, the able French governor of Pondicherry, captured Madras, and by intriguing with the native princes attempted to make French power supreme over the country. In this ambitious scheme he was checkmated by the stupidity of the corrupt French court, which sent him no support, and by the genius of Robert Clive, who from a clerkship in the East India Company rose to be one of the greatest of English generals and the founder of British rule in India (*see* Clive, Robert). The prolonged and desperate struggle in America and in India ended by the Peace of Paris, a few days before the treaty which closed the conflict in Europe (Feb. 10, 1763). France ceded to Great Britain the whole of Canada, together with various islands in the West Indies. The captured French trading stations in India were restored but were not to be fortified. Spain, which had been drawn into the war on the side of France, ceded Florida to England (which held it until 1783), while France compensated Spain with the cession of the Louisiana country west of the Mississippi.

It is not too much to say that the Seven Years' War was a turning point in the world's history. Prussia emerged triumphant and stamped with the military prestige and doubtful diplomacy of Frederick. The Prussian-Austrian struggle for leadership

in Germany was now fairly begun. France, shorn of her colonies and with diminished prestige in Europe, was headed for revolution unless vigorous reforms saved her. Great Britain had acquired a world empire on which the sun never set. The colonies in America had a new conception of their own power and place in the British Empire, and George III was blindly confident that the glories of England's triumph gave the king new power and prestige. The future clash between colonists and the mother country was inevitable.

SEVIER (*sĕv-ēr'*), JOHN (1745–1815). When in 1780 a band of about a thousand American frontiersmen charged again and again up King's Mountain, N.C., and finally defeated the British, their right wing was led by John Sevier, a frontiersman and Indian fighter of eastern Tennessee. Of the many courageous men who aided in winning the region beyond the Appalachian Mountains, Sevier is by far the most dashing figure. He was not, like most of these men, a crude uneducated frontiersman, but was an educated "gentleman," who traced his ancestry back several generations to a French Huguenot family named Xavier. He was born in Virginia, married at the age of 17, and at the age of 19 founded the settlement of New Market in the Shenandoah valley, where he became a celebrated Indian fighter. In 1772 he removed beyond the Alleghenies to the Watauga settlements, in land claimed by the colony of North Carolina. His learning and bravery made him the natural leader of the people of that district, and they turned to him in all emergencies. They learned anew his fighting ability when he served as captain in 1774 in "Lord Dunmore's War," the name given to the expedition which that governor of Virginia led against the Indians on the Ohio; and again when, during the Revolution, he was one of "Marion's men," and was made a brigadier general.

So, when the people of western North Carolina (Tennessee) revolted in 1785 and formed a separate state, which they named "Frankland" or "Franklin," they elected Sevier its first and only governor. After a three years' struggle with the state of North Carolina, "Franklin" ceased to exist. Sevier for a time was imprisoned by the North Carolina authorities, but escaped. He was then allowed to take his seat as a member of the North Carolina senate, and in 1790 was sent to Congress. When Tennessee was finally made a separate state, he served as its first governor, 1796–1801, and again in 1803–09. At the time of his death he was a member of Congress, having been sent there again in 1811, and was engaged in negotiations with the Creek Indians of the south.

SÉVIGNÉ (*sā-vēn-yā'*), MADAME DE (1626–1696). Here was a beautiful, brilliant, warm-hearted woman whose remarkable correspondence with an absent daughter has made people call her "the queen of letter-writers." She was born in Paris, and her maiden name was Marie de Rabutin-Chantal. She grew up to be a lovely, fair-haired, bright-eyed girl, with a velvety skin and graceful ways. At 18 she married a spendthrift marquis, who managed to be killed in a duel, leaving her with a son and a daughter. All the fashionable circle in which she moved admired her beauty, her delightful conversation, and her kind generous heart. It was almost too kind and generous, and poured out far too ardent an affection upon her little boy and girl, who, it must be admitted, grew up into selfish, weak, snobbish creatures, although the daughter did inherit her golden-haired mother's fair face.

When this girl married the Count of Grignan, lieutenant-general of Provence, in the distant south, and thus had to spend most of her time away from Paris, Madame de Sévigné was heartbroken. But it was to this circumstance that we owe the wonderful letters which she wrote to this spoiled petulant daughter, during 25 years. The letters are filled with many little chatty gossipy things, which tell us more than a solemn history ever could about the real life of those days. But what people like most about these letters is their deep affection, bright humor, sincerity, and freshness. For Madame de Sévigné seems to have taken her own delightful, observant, laughing, living self, and put it upon paper for all time.

SEVILLE (*sē-vĭl'*), SPAIN. It is said that there is never a day when the sun does not shine in Seville, "the pearl of Andalusia," the most Spanish of cities, whose palms and gardens are always green along the brown course of the Guadalquivir. Roses bloom the year round, and olive trees, oranges, and vines flourish.

But Seville is at the height of its glory in April, when the orange trees burst into bloom almost overnight and fill the city with fragrance. "The air is very soft, as of April in Seville" was Columbus' expression of delight as he approached the West Indies in 1492; and it is still the ideal of every Spaniard who can to get to Seville for the great religious processions of Holy Week and the gay spring festival coming at the middle of April.

One of the oldest Spanish cities, Seville still has many traces of the days when it flourished under the Moors, 700 years and more ago. Though there are many fine broad modern boulevards, in the older quarters the streets are crooked and sometimes so narrow that a donkey's swinging baskets of fruits and vegetables touch the house walls on either side. The whitewashed houses have balconies that overhang the street, and through the open gateways one catches glimpses of *patios* or central courts after the oriental fashion, with fountains and orange trees and trellises of flowers. In such ancient streets, life goes gaily on as in the days of old, to the strumming of guitars and the clicking of castanets. Four of the best known operas have sought to catch the color and gayety of street life in Seville: Mozart's 'Marriage of Figaro' and 'Don Juan', Bizet's 'Carmen', and Rossini's 'Barber of Seville'.

Moorish too is the famous Alcazar, which in spite of much rebuilding remains an example of the Moorish fortress palace comparable only to the Alhambra at Granada—a place of gardens and lofty arabesqued halls and courts. Seville possesses magnificent architecture of the Christian type as well, notably its cathedral, which is one of the largest Gothic temples in existence—380 feet long by 250 wide, with the tower-like pillars of its dimly lighted nave soaring to a height of 132 feet. Begun in 1402, it was over a hundred years in building. From the earlier Moorish mosque it retains its beautiful court of oranges, and the Giralda, once a minaret, now a belfry. This delicately wrought tower is so strong that it has withstood earthquakes which all but ruined the mighty cathedral itself. In the cathedral, in the museum, the hospital, and elsewhere one is surrounded by works of the painter Murillo, who, like Velasquez, was born in Seville.

From its wharves among the trees, ocean vessels carry abroad Seville's wines, olives, oils, oranges, and ores. For Seville, although nearly 60 miles from the sea, is Spain's fourth largest city and has been an important seaport from the earliest times, since the Guadalquivir is a tidal stream even above Seville, and admits ships of considerable draught. For many years Seville had a monopoly of the American trade, thereby becoming the richest port of Spain. The city still preserves in its archives documents relating to the discovery and conquest of America; autographs of Pizarro, Cortez, Magellan, and Americus Vespucius; and a signed letter of Cervantes applying for a position in America. In a library founded in the early 16th century by a son of Columbus, Fernando Colon, there is an important manuscript record of Columbus' voyage; and the ashes of Columbus himself now rest in the cathedral, to which they were brought from Havana at the end of the Spanish-American War.

Seville was an important center in Roman times. Part of its water supply is still brought by a Roman aqueduct. It passed into the hands of the Vandals and of the Visigoths; and in 712 it was captured by the Moors, remaining a Moslem city until its recapture in 1248 by Ferdinand III of Castile. Since before Roman times, Triana, a suburb on the right bank of the Guadalquivir, has made pottery. Other important industries are the manufacture of tobacco, chocolate, soap, corks, iron, and silk. Seville has a famous university. Population, about 230,000.

SEWARD (*sū'ẽrd*), WILLIAM HENRY (1801–1872). In the spring of 1860 William Henry Seward, then the recognized leader of the Republicans, left his seat in the United States Senate and retired to his home at Auburn, N. Y., to await the expected news of his nomination for the presidency by the national Republican convention in session at Chicago. To his surprise and chagrin the nomination was given to Lincoln, an Illinois lawyer, whose name was scarcely known outside of his own state.

Seward's surprise was natural, for he had been a brilliant lawyer and a leading figure in New York and national politics for 30 years. He was graduated from Union college at the age of 19, and admitted to the bar two years later. He played politics as easily as he breathed, and he had a ready gift of flowery eloquence. Once, when Lincoln and Seward were on a trip together, and a crowd was calling for a speech, Lincoln turned to Seward, and said, "Seward, you go out and repeat some of your *poetry* to the people."

Seward had served as New York state senator (1830–34), as governor of that commonwealth (1839–43), and for 12 years as United States senator (1849–61). He had long been conspicuous as a foe of slavery, and in 1850 he had created a sensation by a speech in the Senate when he had declared: "The Constitution devotes the Domain (i.e., the territories) to liberty. But there is a *higher law* than the Constitution which devotes it to the same noble purpose." Like Lincoln he had later seen that there was an "irrepressible conflict" between the principles of slavery and freedom, and that the nation must become either all slave territory or all free.

He Accepts Lincoln's Leadership

In consideration of his experience and ability it is no wonder that Seward was deeply disappointed when Lincoln was the one who received the Republican nomination. Nevertheless he hid his chagrin and accepted the position of secretary of state in Lincoln's cabinet. At first he felt, as did most of the country, that he would be the power behind the throne and the president would be a mere figurehead. Soon after Lincoln took office Seward wrote to his wife, "If I am absent only three days, this administration, the Congress, and the District would fall into consternation and despair." In a short time, however, Lincoln had tactfully but unmistakably demonstrated that *he* was the head of the government. Seward's opinion of Lincoln's qualities became so changed that in a later letter to his wife he said: "Executive skill and vigor are rare qualities. The President is the best of us."

During the war Seward had a wide field in which to display his patriotic abilities, and he rendered invaluable service. In spite of the difficulties with England (*see* 'Alabama' Claims; Trent Affair) he managed relations with that country and with France so that neither recognized the independence of the Confederate States, although each had at times seemed inclined to do so.

So prominent a part did Seward play in the administration that on the night that an assassin's bullet struck down Lincoln, an attempt was made on Seward's life also. The wound did not prove fatal, and for four years more Seward carried the heavy burden of the office of the secretary of state, under President Johnson. His greatest achievement after the close of the war was the negotiation of the treaty by which the United States purchased Alaska from Russia, in 1867 (*see* Alaska).

SEWERAGE. Life insurance experts tell us that the span of life is growing longer. You can expect to live longer than your grandfather, just as the people of his generation lived longer on the average than those of the generation before. This is chiefly the result of our increased knowledge of the causes of disease and improvements in hygiene and sanitation. Among the various factors which help to make life safer and longer today, none perhaps is more important than the science of sanitary engineering, which so greatly reduces disease by safeguarding our water supply and removing poisonous wastes from our houses (*see* Plumbing; Waterworks).

Sewers are built of brick, cement, or stone masonry, and may be 20 feet or more in diameter. Sewage is carried through them generally by natural flow, or gravitation, although sometimes pumping stations are necessary to distribute it properly. The refuse should be mixed with plenty of water to insure a steady flow—at least 2½ feet a second—and in many places rain water and other surface drainage which must be carried away is conducted into the sewers through the catch basins in the gutters. This plan, however, is open to objections, because sometimes sewer gases escape as the storm water enters; and the more sanitary plan is to keep the pipes of the surface drainage system separate from those of the sewer system. In the latter system the flushing of the sewers is done from tanks supplied with water from the city waterworks.

The disposal of sewage, involving some of the most difficult of all engineering problems, has long engaged the attention of city health departments. In small communities each house disposes of its own sewage, usually in the soil, taking care not to contaminate wells or other water supply; but in crowded towns other means must be used.

Sometimes sewage is conveyed out of town to deep water in seas, lakes, or rivers; but even in large bodies of water this often pollutes the drinking water supply, causing typhoid fever and other diseases. It was in order to avoid polluting its water supply from Lake Michigan that Chicago built her $70,000,000 drainage canal (*see* Canals). The more scientific methods of sewage disposal consist of chemical filtration and treatment, so as to kill all organic matter and make the solid matter, or sludge, available as a fertilizer; and the use of bacteria in *contact beds* and *septic tanks* to purify the sewage. Another method is by broad irrigation, or sewage farming—the utilization of sewage in growing crops. The sewage is run over a large area of land and left to oxidize in the air. The Chinese thus make use of material which otherwise would be wasted. The world's largest sewage farms are those of Paris and Berlin.

Such systems of sewage disposal as are in use today date only from about the middle of the 19th century. During the Middle Ages open drains running through the streets served as sewers. In later times the sewage was conducted to open cesspools on the outskirts of the city. The ancient Romans had sewerage systems far in advance of anything known in Europe until the 19th century, draining the city by three natural streams confined within stone tunnels. The largest of these, the *Cloaca Maxima*, parts of which date from the 3d century B.C., is still in use.

How to SEW *and Keep a* WARDROBE *in Repair*

SEWING. "Really, does it pay to sew nowadays?" One often hears that question, in these days when smart ready-to-wear garments are easily available. The answer is quite simple: sometimes sewing pays, and sometimes it does not.

Assuredly, we have today a different set of life values than people had in the days when pale little girls sat long hours over foolish samplers or patchwork quilts, when they should have been playing and growing strong. It does not pay to do a trivial thing at the expense of an important thing.

Good Sewing Aids Smart Grooming

We live our lives today with a less heavy-handed touch, and much of the advice in old, or even fairly recent, books on sewing is pure nonsense. Nevertheless, we still need proper clothing, we pay more attention than ever to a smart, neat, well-groomed appearance. Many a girl goes about self-consciously in a ready-to-wear garment slightly too large in the sleeve, too sloping in the shoulder, too uneven in the hemline, simply because she can not take the few necessary stitches to correct the garment and adjust it to her own proportions, and perhaps can not afford to pay someone else to make the alterations.

Some knowledge of cloth is desirable if the shopper wishes to avoid disappointment, but a knowledge of the merchandising methods of the store at which you buy the cloth is even more desirable. Genuinely defective merchandise is replaced, and goods are not misrepresented, at the better class of shops.

When "Imitations" Are Worth Buying

The purchaser of today has learned not to shudder and reject a piece of woolen cloth because it contains a few threads of cotton. The cotton frequently gives a firm quality to the cloth which is absent from pure wool. Weighting of silks is not necessarily objectionable if the silk is to go into a garment not expected to give long or hard wear, such as an evening dress or party frock. Styles change so rapidly that long wear is not the much-to-be-desired trait in cloth that it was in the make-it-over-for-sister era.

For example, suppose you wish to make up a little afternoon dress. Here is silk for $2 a yard, weighted so that it drapes beautifully, of good color, pleasing texture, appropriate to the type of dress you desire. Here is another piece, pure silk, unweighted, costing $8 a yard, not very different in effect from the cheaper goods. Certainly the $8 silk will wear interminably.

Do you want the same old dress coming up for remodeling, year after year? Will not your evening and afternoon dresses go out of style long before they are worn shabby, even if made of less expensive materials? Would not four dresses at $2 a yard be more interesting than one at $8 a yard?

Clothing should give pleasure and exhilaration as well as service. Only garments intended for very rough wear need to be made of extremely serviceable materials. Of course, if weighted silk or mixed wool has a cheap appearance, the shoddy look is objectionable. But the market is full of charming low-priced materials, which need not be rejected because they do not offer a lifetime of wear.

Many delightful dresses, of smart, simple style, are so inexpensively priced that it would be a luxury to make them yourself. But if you want a dress of a certain very becoming color, of a certain style which you particularly admire, it may be worth while to make this essentially individual frock yourself. Lingerie which wears well and washes well is usually priced so high that it is a real economy to make it. Blouses are not produced at nearly the same level of smart style and low price as are dresses. It often pays to make them. Cheap, weighted silks can not be laundered, and sleazy, washed out slips, nightgowns, and blouses are very depressing objects.

Learn Sewing Lingerie First

For the beginner who has not yet acquired swiftness, manual dexterity, and familiarity with the most important stitches, it is well to begin with lingerie. The very young beginner may do even better by hemming curtains and towels, making doll-clothes, aprons, pretty pillow tops, simple quilt tops, or repairing little rips and rents. Remodeling a garment may seem a safe task for a beginner, but in fact, it requires more skill to remodel a dress smartly than to make a new one with a free hand as to lines and materials.

Good Patterns Save Time and Money

The modern pattern guides the purchaser both as to quantity of goods, method of laying the pattern economically on the cloth, altering the pattern for individual requirements, and finishing the garment. The patterns of today are very good indeed, and it is scarcely worth while for the non-professional seamstress to learn to cut a pattern to measure. Unless your figure, or that of the person for whom you are sewing, is of very unusual proportions, you may make all necessary alterations by pinning up the paper pattern, slipping it on the wearer, and making such adjustments in the paper as are necessary, according to the pattern alteration instructions.

Handling a "Bias" Correctly

Once a garment is cut, it should be folded and kept lying flat. The amateur seamstress is often obsessed with the desire to drape the cut pieces over the back of a chair, thus fatally stretching the bias edges. If biases are an unknown quantity to you, take your handkerchief, pull it along its hemmed edge, then pull diagonally from corner to corner, and feel it stretch. A diagonal of a perfect square is a perfect bias. It stretches. If you do not want a bias edge to stretch, stay it with a piece of straight goods or thin ribbon. If you require a stretchy binding to go around a curve, select a bias strip.

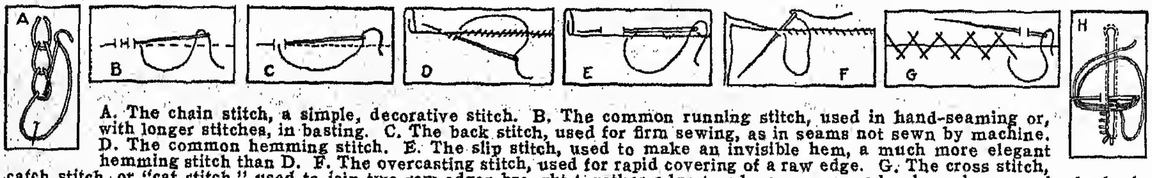
If you honestly do not care to "bother" with the little niceties of hand sewing, then it is better to buy ready-made garments or hire them made, reserving the mental discipline of fine handicraft for attainment in some other field.

Hand Hems and Whipped Seams

On the other hand, it is well to know where to draw the line in niceties of finish. A beautifully executed hand hem adds to the refinement of a garment. Carefully whipped seam edges, on the other hand, take up time from our lives which should go to reading books, taking walks, enjoying friends, attending the theater. Whipping seams is as foolish a waste of time as sweeping carpets with a broom now that the vacuum cleaner has provided a better way. Pinking-shears are rather expensive, but the seams in a garment may be satisfactorily finished by pinking in about ten minutes. Whipping all seams in one dress would run to four or five hours.

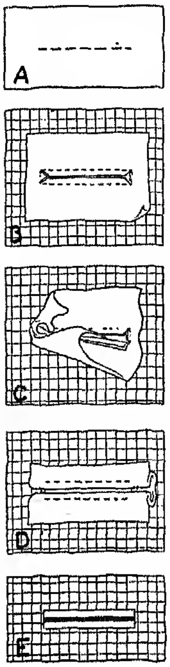
The stitches which it is essential to master before you can sew well enough to make a dress properly are those illustrated in Fig. 1 from B to G inclusively—the simple running stitch, the back stitch, the simple hem, the slip stitch hem, overcasting, and the cross stitch. It is also useful to know the chain stitch and other simple embroidery stitches, and to be able to make a smart, professional-looking buttonhole, as shown in Fig. 1 H. Buttonholes should always be worked with buttonhole twist, never with ordinary sewing silk. Anything short of perfection in the operation of this stitch will result in an ugly "pig's eye" affair, a detriment to the garment. If you can not make a correct buttonhole, either turn this task over to a tailor, or learn to make bound buttonholes, which are easier to master, quicker to make, and in most cases

FIG. 1. EIGHT COMMON STITCHES THE SEAMSTRESS MUST KNOW



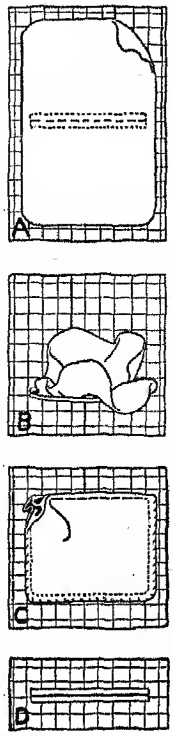
A. The chain stitch, a simple, decorative stitch. B. The common running stitch, used in hand-seaming or, with longer stitches, in basting. C. The back stitch, used for firm sewing, as in seams not sewn by machine. D. The common hemming stitch. E. The slip stitch, used to make an invisible hem, a much more elegant hemming stitch than D. F. The overcasting stitch, used for rapid covering of a raw edge. G. The cross stitch, catch stitch, or "cat stitch," used to join two raw edges brought together edge to edge; or a raw edge lapped over as in the back of a coat collar. H. The true buttonhole stitch, showing properly cut buttonhole, with round hole at end made by a punch.

FIG. 2. HOW TO MAKE A BOUND BUTTONHOLE



Select a scrap of cloth large enough to accommodate the buttonhole, preferably a bias piece, and mark the cutting line on it A. Place it on the right side of the garment, at the point where the buttonhole is wanted, stitch it as shown by the dotted line in B, slash buttonhole, miter corners, and snip away the triangle of cloth at each end left by the mitering. Pull the edges of the binding through onto the wrong side C. Adjust the cloth on the wrong side D, and stitch it in place with a back stitch, sewing from the right side and throwing the long stitches onto the wrong side. Tack each corner firmly. The finished buttonhole should appear as in E. If the edge of the garment is faced, slash and hem the facing around each buttonhole.

FIG. 3. HOW TO MAKE A BOUND POCKET

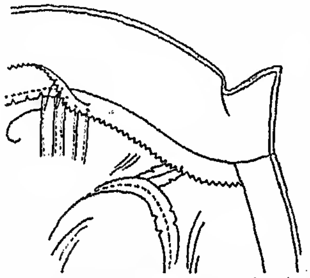


A bound pocket is made in much the same way as a bound buttonhole. The material for the pocket, not bias, is placed on the right side of the garment, stitched, slashed, mitered, and turned to the wrong side A and B in the same manner as described for the bound buttonhole. The pocket material is then attached to the upper edge of the bound pocket with a back stitch, as in finishing the buttonhole, except that the material is folded over to form a pocket C. Then stitch the pocket around the edge, and make the corners secure with strong stitches. The finished pocket is shown on the wrong side in C and on the right side in D. If the garment is not to be lined, a more careful finish may be given to the raw edges of the pocket.

ever so much smarter. (*See* Fig.2.) The buttonhole stitch is well worth learning, however, to use in attaching hooks-and-eyes, and in other cases where firmness and strength in the stitch are important. The true buttonhole stitch is often confused with the blanket stitch, which does not give nearly so strong an edge and is totally unserviceable in a buttonhole.

In all sewing, the seamstress should strive to acquire lightness of touch, never pulling and yanking the cloth, never "sewing a garment to death," as is the way of conscientious amateurs, but putting in just enough stitches to accomplish results. Facings and hems caught down with zeal and many stitches will show on the right side, and give that dowdy, home-made look. They must be caught lightly, gently, invisibly, in the way that our grandmothers were very patiently and firmly taught *not* to sew. (*See* Fig. 4.)

FIG. 4. AN INVISIBLE FACING



Do not hem facings down tightly, but "pink" them, tacking them gently at seams or tucks, where the stitches will not show.

Sew Small Parts First

If possible, sew with the work resting on a small table, such as a card table, particularly if you are at work on a large garment which will pull at the needle if left sagging into the lap or onto the floor. As far as possible, finish smaller parts of the garment before attaching them to the body of the dress. That is, make sleeves complete, with wrist fasteners attached, the wrist edge hemmed, the seams pressed flat, before setting in the sleeve. Ruffles, circular overlays in skirt or blouse, collars, and the like, should be hemmed before setting on to the garment, unless some peculiarity of cut makes such a method undesirable. In sewing as in other handicraft, common sense is the best guide in workmanship, good taste the only guide in design and color. There is no substitute for either of these unteachable requisites. If you do not employ your common sense in sewing, but work blindly by rule of thumb, you will inevitably make some absurd blunder. If you do not employ either your own good taste or that of someone else, your garment will be frumpish, of bad line, and not successful, regardless of perfect stitching.

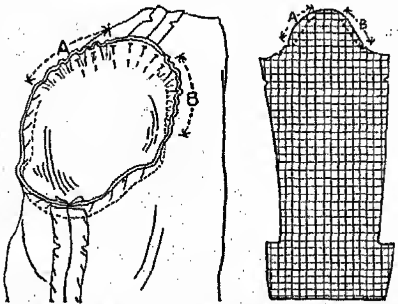
Although modern patterns and their charts are extremely well done, some of them nevertheless give misdirection on three matters: setting in a sleeve, cutting a placket facing in one with the placket opening, and lining a coat.

Putting in Sleeves.

Many illustrations in sewing guides direct that a sleeve be fulled entirely across the top, the purpose behind the recommendation being to accommodate the bulge of the shoulder and to adjust the bias edge of the sleeve. Nothing could be better adapted to giving a dowdy look to the finished sleeve, with puckers at the top of the shoulder, insufficient fulness at the "round" of the shoulder, and every other possible arm-scye defect.

Always remember that to achieve the proper effect, the fulness of the sleeve should be held on two separate threads, as you see done in the left-hand sketch of Fig. 5. Under no circumstances should a gathering thread be run across the top of the sleeve, unless the sleeves are actually to be fulled with definite gathers into the arm-scye, as in the leg-o-mutton type of sleeve. The sleeve should be basted into the arm-scye with the sleeve held toward the seamstress, to take care of the fulness.

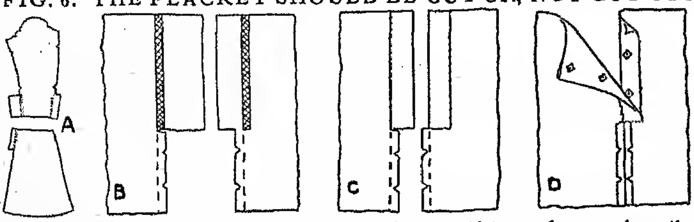
FIG. 5. SETTING IN A SLEEVE



The sketch at right shows, at A and B, where to put a gathering thread in the top of a sleeve, in two parts, never with fullness at the top of the shoulder. At left is the sleeve pinned in the arm-scye.

The seam should run evenly over the top of the shoulder, not running in toward the neck, nor dropping down in a clumsy, un-

FIG. 6. THE PLACKET SHOULD BE CUT ON, NOT CUT OFF



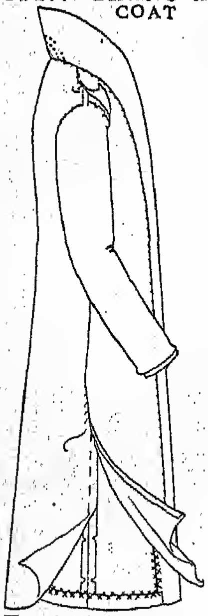
It is a common, and foolish, practise to cut sleeves, skirts, or dresses along the seam lines, then patiently sew cloth back on wherever plackets are necessary. At A are sleeve and skirt with plackets cut in one with the piece, dotted lines showing ordinary cutting line. At B is shown the staying of the placket by cross-stitching on the wrong side a piece of straight cloth, or seam-binding ribbon. At C is the placket hemmed down, before the seam is taken. Instead of hemming, one may pink these edges and let them be caught down only by the snaps or hooks-and-eyes used for closing. The finished placket is at D. This method may be used for plackets on skirts, along under-arm seams, or on sleeves.

couth way off the shoulder. (*See* Fig. 11.) Nothing is more important in the smartness of a dress than the fit and the smooth attachement of the sleeves.

The Right Way to Cut Plackets

Custom seems to perpetuate the practise of patiently cutting the goods away from a placket edge and then patiently sewing it back on again. Logic plainly indicates that the placket facing may be cut in one with the placket edge, and the bias tendency may be held in check by a bit of straight goods or preferably a strip of seam-binding ribbon. (*See* Fig. 6.) Plackets on skirts, along under-arm seams at the waist-line, or on sleeves, may all be "cut on" at the time the garment is cut out, instead of cut off and sewed on, in the usual unintelligent, labor-making way.

FIG. 7. LINING A COAT



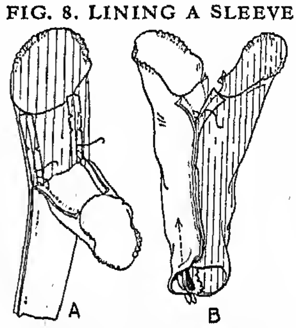
Here is shown the lining of a coat as described in the text, with the back lining caught to the seams, and the fronts hemmed down. The hems on the coat proper are held by cross-stitch.

Lining a Coat

Linings should be cut slightly larger than the garment to be lined, *never* slightly smaller, as the amateur reasons. A lining smaller than the garment pulls the outer cloth in gawky pouches and bellows. The extra fulness may be adjusted by small pleats at the back of the neck, on shoulder seams, and the like. The method of sewing all lining seams together, then applying the entire lining to the inside of the coat, is that used in the cheaper ready-to-wear garments, and in many unsatisfactory sewing guides. It permits sagging, and a loose fit.

The correct way is to put the garment wrong side out on a dress form; pin the back piece of the lining in place on the coat, and attach it rapidly to the outer fabric at the seams, with a long running stitch. Then pin the sides in place, turn an edge at the seams, and hem the sides down onto the back at the seams. Also hem them down onto the front facing. (*See* Fig. 7.) Hem up the bottom, either in a loose hem, or with a fold of goods, if it is a suit jacket (*see* Fig. 9). Last of all, sew up the seams of the sleeve lining, if it is a two-piece sleeve, as most coat sleeves are, and press the seams as shown in the drawing, turn the linings wrong side out, and sew the seams of the lining to the seams of the sleeve, with a long running stitch (*see* Fig. 8). Then run your hand down through the lining, grasp the wrist end of the sleeve, and pull it gently through the lining. You will then have a sleeve wrong side out, with its lining in place. Hem down the lining at the cuff, leaving a fold of the lining for the play of the arm. Sew the lining to the shoulder seam with a long running stitch. Hem down the body lining around the arm-seye upon the sleeve lining, as illustrated, with a concealed hemming stitch, or slip stitch. *Never* hem the sleeve lining down onto the body lining. If you do, it will give a crude, puckery effect, and when you pass your arm into your sleeve, you will be continually rubbing against the edge of the sleeve lining. A lining thus placed in a coat, since it is attached to the seams, can never sag or work out of place.

FIG. 8. LINING A SLEEVE



The sleeve seams are sewed and pressed flat; the lining seams sewed and turned as shown in sketch A. Lining seams are sewed by hand to the sleeve seams, to within three inches of either end of the seam. Then run the hand down through the lining, catch the wrist of the sleeve, and pull the entire sleeve up through the lining, as in B. This "skinning the cat" gives you the sleeve, wrong side out, with the lining in place.

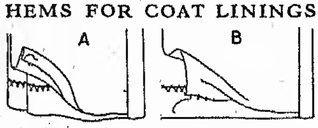
Patching and Repairing

Even though busy people may not feel it advisable to make entire garments, they are all confronted with the necessity of repairs. Elbows of snug sleeves will break out in a hole, long before the wearer is willing to discard a favorite frock. Patching is only to be encouraged when it is done cleverly, artfully, so that it does not look like a patch. A garment repaired with an ugly, square patch is a garment ruined, something which undermines your poise and makes you fidget with self-consciousness every time you bring yourself to wearing it.

The Golden Rule in Patching

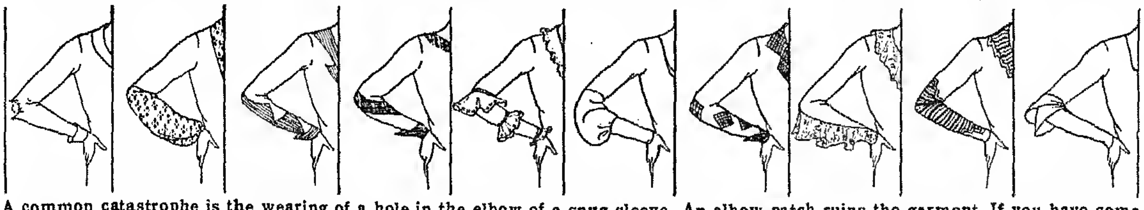
The sketches in Fig. 10 suggest a number of clever ways of meeting the sleeve difficulty. If a small girl tears a hole in the front of a skirt, a clever mother can

FIG. 9. HEMS FOR COAT LININGS



A shows the lining of a long coat, hemmed separately with a slip stitch hem. B shows a jacket lining hem, used either at the bottom of the jacket or the wrist of the sleeve. The lining is hemmed fast to the cloth of the coat, but with a loose fold so the lining will not pull.

FIG. 10. NINE CLEVER WAYS TO AVOID AN UGLY ELBOW PATCH



A common catastrophe is the wearing of a hole in the elbow of a snug sleeve. An elbow patch ruins the garment. If you have some pieces of the cloth of your dress, the sixth and tenth pictures suggest means of making useful elbow repairs. If you must use contrasting goods, the other sketches offer valuable methods of renewing the sleeve. Of course, the contrasting material must also be applied elsewhere in the garment, either as collar, belt, appliqued design, vest—whatever is suitable to the style of the garment. Contrasting goods in the sleeve alone would be bizarre.

sew on two handy little pockets, one of which hides the hole, or cut a slit and attach a circular overlay. If a plaid or figured fabric develops a hole, the patch may follow the plaid or the design of the figure so cleverly that it is not seen. The first requirement in intelligent patching is the mental resolve, "I *will* find a way to repair this hole without putting on a stupid square patch!"

As a rule, if a garment actually wears in a hole, it is not worth mending. There is not enough strength left in it to repay you for your time. Accidental tears or burns are a different matter.

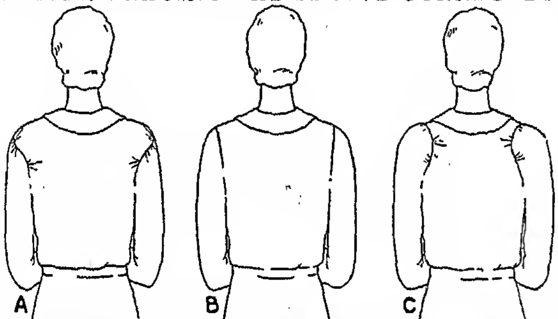
Professional Reweaving Best

If the hole is small and the garment valuable, it is far better to have it repaired by reweaving, which is done most skilfully in mending shops in cities. To repair a hole by darning, except where it is not visible in the foot of a stocking, is merely to add insult to injury, so far as the appearance of the damaged article is concerned. Such exquisite darning as was done by Elsie Dinsmore in the table-cloth episode is quite definitely out of the picture these days, and it is the modern verdict that Elsie's waste of the precious hours of life well merited the severe treatment accorded her by her elders.

Proper Equipment for Home Sewing

The equipment for home sewing should include gold-eyed needles of assorted sizes, a tape measure, a yardstick, French chalk, a well-fitting thimble of good metal (not of cheap tin or celluloid), an emery ball, a lump of genuine beeswax (not paraffin), a bowlful of steel pins (not the usual thick, fabric-damaging type), an excellent pair of shears, with the handles off-center, for cutting out garments, a pair of scissors to remain beside the sewing machine, a supply of hooks and eyes and snap-fasteners in various sizes in white and black, a standing ironing-board and electric iron in good order, a sleeve-board, a heavy tailor's linen press cloth, and, if the budget can possibly allow it, a pair of pinking-shears which will save hours in finishing seams. No one can produce a finished result without the use of proper tools.

FIG. 11. PLACING THE SLEEVE CORRECTLY



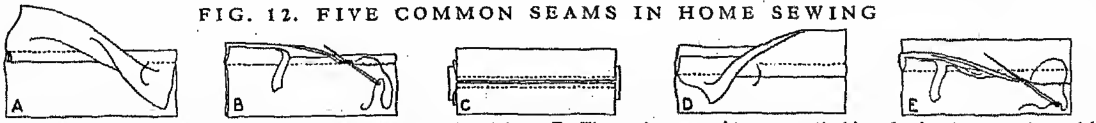
A garment may be "made" or spoiled by its sleeves. In sketch A the sleeves are put in too low, with a sloppy dropped line. In C they are too high, and the garment strains across back and chest. In B the correct placing, the sleeve seam forms a continuous straight line with the outline of the body.

Proper Threads to Use

Thread should be bought at the same time as the fabric, and matched by daylight. Although it is a fad to sew woolen garments with color-fast cotton thread, this is undesirable. Cotton thread will draw up in wet weather, causing seams to pucker, and if the garment is to be dyed at some time, the cotton thread may take a different tint from the wool. All basting should be done with silk thread of the color of the garment, as silk slips through the cloth when the basting thread is pulled out and does no harm to the cloth.

A thorough mastery of machine sewing saves hours of time, and a little practise enables the operator to sew without puckering seams, or running into other errors. Certain operations should *never* be done on the machine. For example, no garment should be hemmed by machine unless a decorative treatment of rows of stitching is being used. Hand-made lace should never be attached by the machine, and most people of good

FIG. 12. FIVE COMMON SEAMS IN HOME SEWING



A. The French seam. Sewed first in a small seam on the right side of the garment, then turned in and sewed onto the wrong side. B. The French fell. One edge is cut off the seam, the other folded over and hemmed near the seam stitching. C. The slot seam. Baste an ordinary seam, press flat, place a strip of straight material on under side stitch along each edge of the seam. D. The welt seam. After one stitching, both edges are turned in the same direction and the seam is stitched through three thicknesses. If the first stitching is omitted, and the welt forms a loose tuck, it is called an open welt seam. E. The flat fell. Similar to the French fell, except that the seam lies flat and is hemmed into the body of the goods. A, B, and E are for wash garments.

taste prefer not to use any lace as a trimming if it must be sewed on by machine.

Hand work, and the trim severity of machine work, stand in two separate categories in the mind, and it is offensive to combine them in such operations as sewing lace by machinery. Tucking, ruffling, seaming (except in chiffon or transparent velvet) are, however, operations which are suited to machine work and frequently a waste of time to do by hand.

FIG. 13. STEAMING VELVET

Seams in velvet must be steamed open with a damp cloth placed over a hot iron. It is better not to baste the seam open, but to hold it with the fingers, as the marks of the thread may otherwise be steamed into the pile.

Pressing Garments

Very important in making a garment is proper pressing. Seams must be pressed as the work goes along, not left for one final pressing. Woolens are pressed under a damp piece of tailor's linen, or canvas, with the dressing thoroughly washed out. It is well to bear in mind that pressing is not the same as ironing. In ironing, you rub out wrinkles. In pressing, you press in a fold, either on a seam, or in a plait. Press your iron down, lift it to another spot, press down again. If you press with a damp cloth, leave the goods steaming; *never* press until the garment is dry, as it may leave a gloss.

Press silks with a dry cloth, or one very slightly damp. Press cottons and linens directly on the material. Do not press silk with a very hot iron, since heat injures silk. Artificial silk requires a still cooler iron, as it may be easily melted and ruined with too much heat. Press heavy laces, or goods with a nap, face *downward* on a Turkish towel. Steam velvet over a hot iron covered with a wet towel. (*See* Fig. 13.) Never press down onto velvet.

Hints and Cautions in Sewing

1. Never press metal cloth without testing a scrap of the material. Even a moderate iron may discolor or melt it.

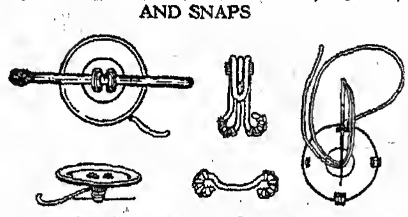
2. Sew on snaps and hooks-and-eyes with a buttonhole stitch, using buttonhole twist as thread, for strength and neat effect (*see* Fig. 14).

3. Watch the pattern carefully so as not to cut two sleeves for one arm. The paper pattern must be turned over in cutting the second sleeve. The cutting guide of the pattern will make this point clear.

4. In notching cloth to correspond with the guide notches in the pattern, avoid making the notches deep, or they may fray in the seam. Better yet, mark notches with French chalk, instead of cutting them in the goods.

5. Learn how to hold your sewing work correctly. If you are sewing away at an edge, with the garment pulling away from you, you are holding it incorrectly.

FIG. 14. ATTACHING BUTTONS, HOOKS, AND SNAPS



A match stick placed over a button before it is sewed on makes the thread form a shank. A few twists of the thread about this shank before fastening the thread will hold the button firmly and make it button easily. Hooks-and-eyes and snap fasteners may be attached more firmly and with fewer stitches if sewn with a buttonhole stitch.

6. Clip all selvages. Selvages are the amateur's delight, because they seem to need no finishing. They are woven more tightly than the rest of the cloth, and pull and pucker if not clipped.

7. Use steel pins to pin together your material before basting. They do not leave ugly holes, as do cheap pins. Avoid leaving them in the goods and allowing them to rust.

8. Shrink woolens and cottons thoroughly before cutting. Shrink silk crêpes if you expect to wash them. Do not attempt to shrink velvet, chiffon, or metal cloth.

9. If two pieces of cloth are to be sewed together, and one piece is fuller than the other, hold the full side toward you. If neither is to be fulled, pin the cloth carefully before sewing, as your tendency will be to full slightly the goods held toward you.

10. *Never* knot the end of a thread, but attach it by one or two small stitches. A knot works through cloth, breaks off, unties, or otherwise misbehaves. A knot in basting thread is invariably yanked through the cloth when the basting is pulled out, leaving a row of frayed holes impossible to repair.

11. If the material used in a dress or blouse is very loosely woven, so that the arm-scye seam, or sleeve seam, is likely to pull out (a mishap very difficult to repair), it is possible to prevent this fraying by operating these seams as slot seams, using a firm piece of material to stay the slot. Use a straight strip for the sleeve seam, a bias strip for the arm-scye seam. If the fraying has already occurred because the seam was not thus treated, it is necessary to recut the back of the blouse to trim away the frayed part. The additional cloth may be inserted in a V-shaped piece, a diagonal, or whatever cut best harmonizes with the design of the garment.

SEWING MACHINE. From the middle of the 18th century many inventors in England and the United States tried to make machines that would imitate the movements of the needlewoman's fingers. The fundamental principles of the successful sewing machine were specified as early as 1790 by the Englishman, Thomas Saint, who patented a machine for sewing leather, but made no practical use of the idea. In 1830 Barthelemy Thimonnier, a poor French tailor, patented a machine, using it for sewing army clothing. In 1831, when he had 80 such machines in use in Paris, an angry mob wrecked the machines, Thimonnier barely escaping with his life. He died in poverty in 1857 after years of struggle to get his machines adopted.

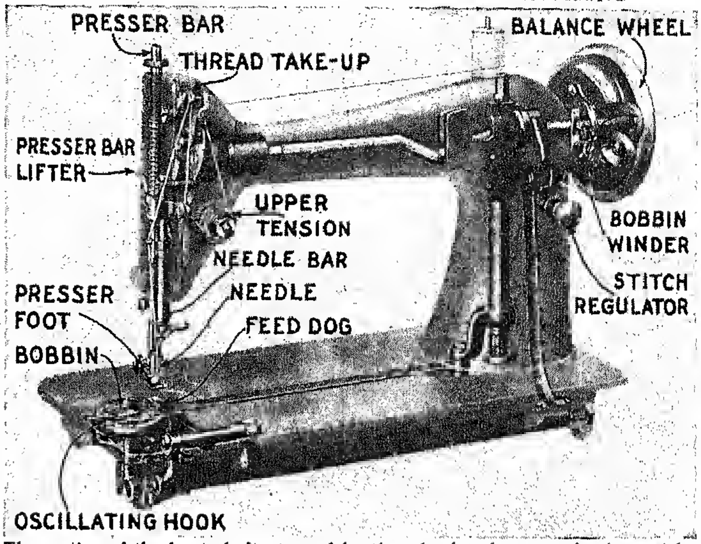
Between 1832 and 1834 Walter Hunt, a Quaker, built in his New York shop a machine "for sewing, stitching, and seaming cloth." His machines could not do curved work, nor sew a seam more than a few inches without readjusting the cloth.

Hunt sold his interest in the machine for a trifling sum to George A. Arrowsmith, a New York blacksmith; but Arrowsmith refused to patent it, fearing that it would rob many seamstresses of their work. Hunt was a prolific inventor, listing among his productions machinery for making nails and rivets, a street-sweeping machine, a revolver and a repeating rifle, and the safety pin. Eventually he bought back his rights to his sewing machine from Arrowsmith, but never devoted himself to its perfection and never realized any great sum on it. So it was not until about the middle of the 19th century that substantial progress was made toward the practical sewing machine.

By that time it was realized that it was not necessary for the whole needle to go through the cloth for each stitch; and the machine needle, with an eye near the point, and the "lock stitch"—such as are in use today—had appeared. The lock stitch makes use of two threads. The first thread, passing through the eye of the needle, is pushed down with the needle through the cloth, and forms a loop below. The other thread, underneath the cloth, is carried through the loop by a shuttle, thus "locking" the stitch.

Such a needle was combined with the lock stitch in a machine patented in 1846 by Elias Howe of Massachusetts. This was the first really practicable sewing machine, but it could sew only straight seams, and the seams could not be longer than the baster plate. The needle moved back and forth horizontally instead of vertically, as in our modern machines. Howe and his machine were denounced by garment workers and tailors, who feared it would deprive them of their means of livelihood. But gradually his machine came into use, and in 1854 the courts sustained him in a long legal fight over patent rights. For about 25 years Howe collected royalties on every machine made, and thus was lifted from poverty to a fortune of more than $2,000,000 (*see* Howe, Elias).

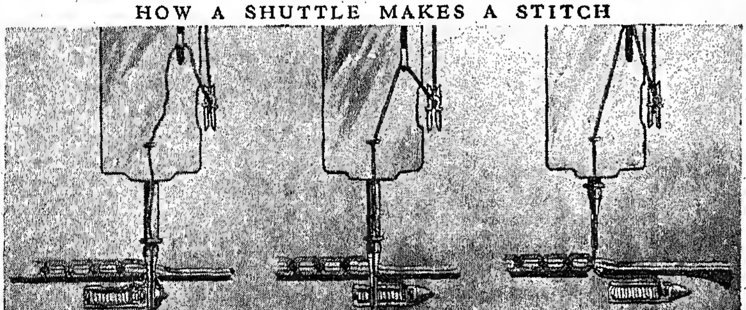
THE SECRETS OF THE SEWING MACHINE



The motion of the bent shaft—turned by the wheel and motor—is changed by cams and levers into the up-and-down motion of the needle bar, the to-and-fro movement of the feed dog, and the rhythmic swinging of the "oscillating hook." The take-up makes the thread alternately tight and loose as needed; the stitch regulator controls the length of the stitch.

One of the defects in the early inventions even in Howe's first machines, was that the cloth had to be "fed" by hand. John Bachelder devised the first machine combining the horizontal table with a continuous feeding device that would sew any length of seam, and patented his improvements in 1849. He used a leather belt set with small steel points to carry the material along. The greatest improvement was made by Allen B. Wilson, a Michigan cabinetmaker, who in 1854 patented his "four motion feed," employed in almost all machines today. This device consists of a toothed metal plate which moves forward, carrying the cloth with it, then drops out of contact with the cloth, moves back, and rises to push the cloth forward.

HOW A SHUTTLE MAKES A STITCH



The three pictures above show how the upper thread catches up the lower to make the famous "lock stitch," the shuttle passing through the loop in the upper thread each time the needle comes down. As the needle rises, the take-up draws the thread taut, pulling the stitch up into place between the layers of material being sewn. Poor adjustment of the tension on the thread may cause the stitch to be improperly made, or the thread may even be broken or snarled.

Meanwhile, Isaac M. Singer had invented the first "rigid arm" sewing machine, and had made important improvements in the shuttle. He finally obtained a patent after a long lawsuit with Howe. James Gibbs invented a "chain stitch" machine, later improved by James Willcox of Philadelphia. In this machine the loop of each stitch passes through and secures the loop of the previous stitch.

These early machines have been developed to such an amazing extent, both for home and factory uses, that today there are machines for sewing almost every conceivable article of clothing, upholstery, embroidery, canvas, leather goods, etc., some of which run as

fast as 4,000 stitches a minute. There are machines for making buttonholes, and others for sewing on buttons. There are machines for faggoting, featherstitching, pattern-stitching, hemstitching, smocking, ruffling, tucking, side and box plaiting, basting, and quilting. There are single and double needle machines, and those with four, six, and eight needles for glove work. Of these special machines the most important is the shoe-sewing machine (*see* Shoes). The household type too has been improved and modified, chiefly in order to carry special attachments, until now the same machine can handle a great variety of work. Both industrial and domestic machines are now commonly run by electric motors.

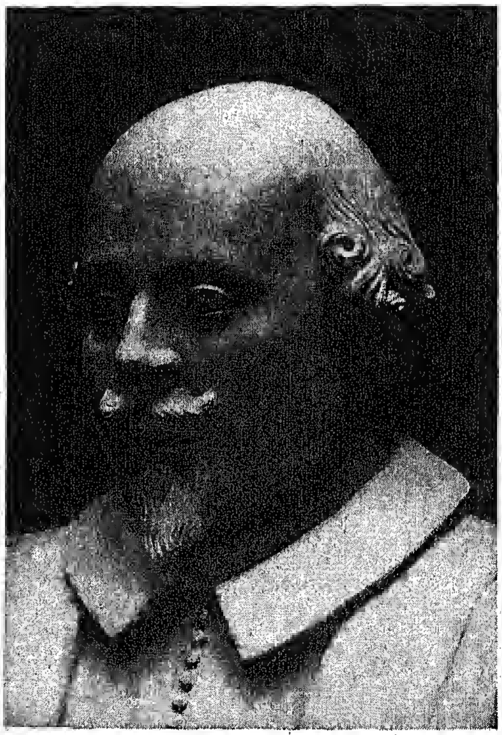
The United States leads the world in the manufacture of sewing machines. Its output goes to the remotest parts of the globe.

SHAD. The American or common shad, weighing from three to six pounds, is an important food fish. It is also prized for its roe (eggs). It lives deep in the Atlantic Ocean, but in spring swims up coastal rivers to spawn. During these runs, millions of pounds of shad are caught with nets. The chief fisheries are in Chesapeake Bay, Delaware Bay, North Carolina sounds, and the Hudson, the Potomac, and the Connecticut rivers. In 1871 shad were introduced into the Pacific, and are now caught commercially in California, Oregon, and Washington waters.

Shad belong to the herring family, but are larger and have deeper bodies than the typical herring. The American shad has the scientific name *Alosa sapidissima*. Another species, the allice shad, is found in the eastern Atlantic. The Mediterranean species is called the twaite shad. (*See also* Fish.)

SHAKESPEARE—*His* LIFE, *His* ART, *and His* TIMES

SHAKESPEARE, WILLIAM (1564–1616). Most of the important known facts about Shakespeare's life are contained in the brief summary on the next page. We also know the dates when his plays were first published and the approximate times when they were composed. Scholars digging in old records have brought to light a few other items relating to his purchases of property, places of residence, and lawsuits, none of them very interesting or important. All that we have beyond this meager body of recorded fact is a mass of legend, traditions, and conjecture, often plausible enough, but not resting on documentary evidence.


This bust of Shakespeare in the church at Stratford was carved by Garret Johnson shortly after the poet's death.

Why do we know so little about so great a man? Why did no one attempt to write his life until nearly a hundred years after his death? There is no mystery about it, as many think. The explanation is that the lives of authors excited no curiosity in his time. We know more about Shakespeare than we do about most of his contemporaries, unless they were of the nobility. If to the known facts we add plausible tradition and conjecture, we can build up a fairly complete narrative of his life.

The Poet's Family and Early Life

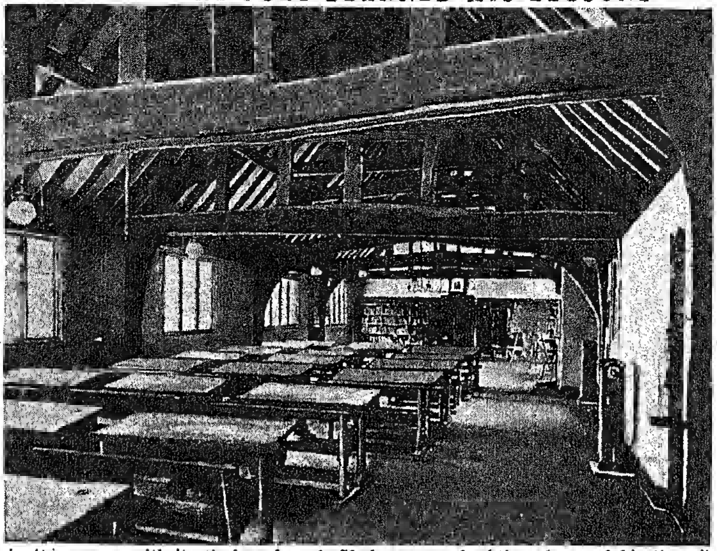
William Shakespeare was born in Stratford-on-Avon in the sixth year of the reign of Queen Elizabeth. He was the eldest son and third child of John and Mary (Arden) Shakespeare. The day of his birth is not known, but he was christened on April 26, 1564, and April 23, the feast of St. George, the patron saint of England, has long been celebrated as his birthday. Two sisters, Joan and Margaret, died before he was born. The other children were Gilbert, a second Joan, Anne, Richard, and Edmund, of whom only Joan survived him.

His father was a tanner and glovemaker, an energetic man, who was for years an alderman of Stratford and for a term high bailiff or mayor. John Shakespeare's fortunes declined toward the end of his life, so that when he died in 1601 he was able to leave William only a little real estate. Of Mary Shakespeare (who died in 1608) we know little except that she was of better family than her husband; her father had been John Shakespeare's landlord.

Stratford-on-Avon is in Warwickshire, a county often called the "heart of England," because it is in the middle of the kingdom—a beautiful county, even then rich in agriculture, though more heavily wooded than it is now. The town was prosperous, clean, and progressive. Not far away were the great castles of Warwick and Kenilworth, and the Forest of Arden. The town was proud of its grammar school, which Shakespeare no doubt attended, though when or for how long is not known. The tradition is that he was a pupil

there between his 7th and 13th years. His studies must have been mainly in Latin. There is no reason to suppose that his schooling was not good; all the four schoolmasters connected with Stratford Grammar School during the boyhood of Shakespeare were graduates of Oxford University.

WHERE THE POET LEARNED HIS LESSONS



In this room, with its timbered roof, Shakespeare doubtless learned his "small Latine and lesse Greeke"; for this is the old Grammar School, in which Stratford boys have been taught from before Shakespeare's time to the present.

Concerning his boyhood years we know nothing definite, but we can safely assume that he had a rare opportunity to become acquainted with the objects of nature, with outdoor sports and trades, and with the rural folk whom he was later to portray with such humor. He certainly amassed a fund of knowledge then and later, for he picked up an amazing stock of facts about hunting, hawking, fishing, dances, music, and other arts and pastimes, as well as about alchemy, astrology, folklore, medicine, and law. His information was of the sort which a poet collects, not only from books, but also from day-by-day observation and hearsay.

He Marries and Goes to London

In 1582, when he was 18, he married Anne Hathaway of Shottery, a little village a mile from Stratford. She was seven or eight years his senior and, evidently on no better foundation than this difference in their ages, a tradition arose that they were not happy.

What he was doing between 1583 and 1592 is not known, though traditions exist that he taught school, was employed in a lawyer's office, was retainer on a gentleman's estate, and traveled with a company of players. The most famous of the legends of this time tells how, about 1584, he and some companions were arrested for poaching on the estate of Sir Thomas Lucy of Carlecote, near Warwick, and were forced to leave town. The story is accepted by some authorities and rejected by others. Less probable is the tradition that he was in London in 1588, holding horses for patrons of the theaters in Shoreditch, and was in time employed indoors as a servitor or callboy.

At any rate, we know that he was in London in 1592, already recognized as an actor and playwright by the time he was 28 years old. In that year the first literary reference to him was made by Robert Greene, another playwright, who accused him of borrowing from the plays of others. Since plague kept the London theaters closed most of the time between 1592 and 1594, Shakespeare occupied himself with the writing of his earliest sonnets and two narrative poems, 'Venus and Adonis' and 'The Rape of Lucrece'. Both 'Venus' and 'Lucrece' were printed by a boyhood friend from Stratford, Richard Field, and both were dedicated to Henry Wriothesley, Earl of Southampton. They were well received by the public and helped to establish him as a rising poet.

His Theatrical Ventures Prosper

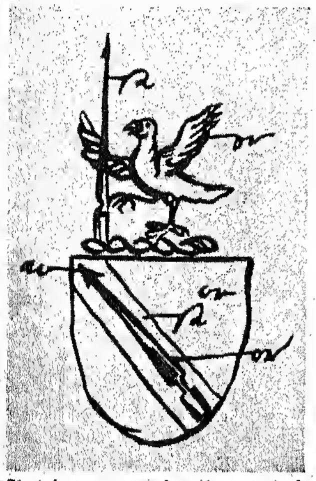
Until 1598, Shakespeare's theatrical activities were apparently confined to the district northeast of London, outside the walls, in the parish of Shoreditch adjoining Finsbury Fields, a favorite spot for picnics, drills, and athletic sports. There two playhouses—the Theatre and the Curtain—were situated. These were under the management of James Burbage, who was the father of Richard Burbage, the greatest tragic actor of the day and Shakespeare's friend. In 1596—and probably for some years before—Shakespeare was living near these theaters in Bishopsgate, where the great North Road entered the city; but some time between that year and 1599 he moved across the river to the district called the Bankside, where two theaters, the Rose and the Swan, had been built by Philip Henslowe, James Burbage's chief competitor as a

CHIEF KNOWN FACTS OF SHAKESPEARE'S LIFE

- **1564.** Born at Stratford-on-Avon, Warwickshire, probably April 21–23, and baptized, April 26
- **1582.** License issued for his marriage with Anne Hathaway of Shottery
- **1583.** Daughter Susanna born
- **1585.** Twins Hamnet and Judith born
- **1592.** First alluded to in a book, by Robert Greene
- **1593.** 'Venus and Adonis' published
- **1594.** 'Rape of Lucrece' published
- **1596.** His son Hamnet dies
- **1596.** His father is granted a coat of arms
- **1597.** Purchases New Place in Stratford
- **1598.** Is praised by Francis Meres, who mentions his poems and sonnets and names 12 of his plays
- **1603.** He and his fellow players are honored by James I; appointed Grooms of the King's Chamber
- **1607.** Daughter Susanna marries
- **1609.** 'Sonnets' published
- **1610–13.** Retires to Stratford
- **1616.** Daughter Judith marries
- **1616.** Dies, April 23, and is buried, April 25

theatrical manager. To this district the Burbages also moved in 1598 and built the famous Globe Theater—so called from its sign, a representation of Atlas supporting the world. With this theater Shakespeare's fortunes were to be connected for the rest of his active life. In it he owned a share, which was the source of most of his subsequent wealth.

Meanwhile, in 1597, he had bought New Place, the largest house in Stratford, and in the next three years he purchased other property there and in London. In the previous year his father, probably at his suggestion, had applied for and been granted a coat of arms. The arms consist of a gold shield with a gold spear on a black bend; above this is the crest, a silver falcon flapping its wings and holding another spear. The motto is *Non sanz droict* (Not without right). From this time on, Shakespeare could write the word "Gentleman" after his name. When we consider that in those days actors were classed legally with rogues and vagabonds, we can understand his desire to win this standing.



Sketch accompanying the grant of arms to Shakespeare's father in 1596. The word "or" means gold.

In 1598 his name first appeared on title pages of printed plays, and in the same year Francis Meres, in 'Palladis Tamia: Wit's Treasury' (a sort of literary handbook), praised him as poet and dramatist and mentioned twelve of his plays by name in terms which prove that his excellence was even then well recognized.

Honored as Actor and Playwright

From about 1602 to 1607 Shakespeare was lodging with a French Huguenot wigmaker, Christopher Mountjoy, and interesting himself in the love affair of his landlord's daughter. He was later rewarded for his efforts by being called as a witness when, in 1612, the young husband sued his father-in-law over the daughter's dowry. In 1603, upon the death of the Queen in that year, the theatrical company to which he belonged was taken under the patronage of James I as the King's Company, and he and his fellow players were made officers of the royal household.

The company with which he was connected as actor and playwright was the most successful company of the time, known successively as the Earl of Derby's, the Lord Chamberlain's, and the King's. In 1608, as the King's Men, the company acquired the Blackfriars Theater in the city, a smaller and more aristocratic house than the Globe. From that time it alternated between the two playhouses. Plays by Shakespeare were performed at both theaters, at the court, and in the palaces of nobles. After 1603 he probably acted little. He appears to have been a competent "character" actor. Late traditions assign to him the rôles of old Adam in 'As You Like It', and of the Ghost in 'Hamlet'. A contemporary poet, however, in 1610 speaks of his performing "kingly parts in sport."

In 1607, when he was in his early forties, he may have suffered a serious physical breakdown. For years he had written two plays a year and sometimes three—a prodigious feat of industry even without his work as an actor. In the same year his elder daughter Susanna married John Hall, a physician, and in the following year bore Shakespeare's first grandchild, Elizabeth. Also in the same year, 1607, his youngest brother Edmund, who had come to London and had become an actor, died at the age of 27.

Poet-Friends of the Mermaid Tavern

By this time or not long after, Shakespeare was a member of the famous group of men of letters who congregated at the Mermaid Tavern in Cheapside. The club was founded by Sir Walter Raleigh, and Ben Jonson was its leading spirit. Shakespeare was a popular member, admired for his talents and loved for his kindliness. Thomas Fuller, writing about 50 years later, no doubt from hearsay, has an amusing account of the conversational tilts of the two poet-friends:

> Many were the wit-combats betwixt him and Ben Jonson; which two I behold like a Spanish great galleon and an English man-of-war; Master Jonson (like the former) was built far higher in learning; solid, but slow, in his performances. Shakespeare, with the English man-of-war, lesser in bulk, but lighter in sailing, could turn with all tides, tack about, and take advantage of all winds, by the quickness of his wit and invention.

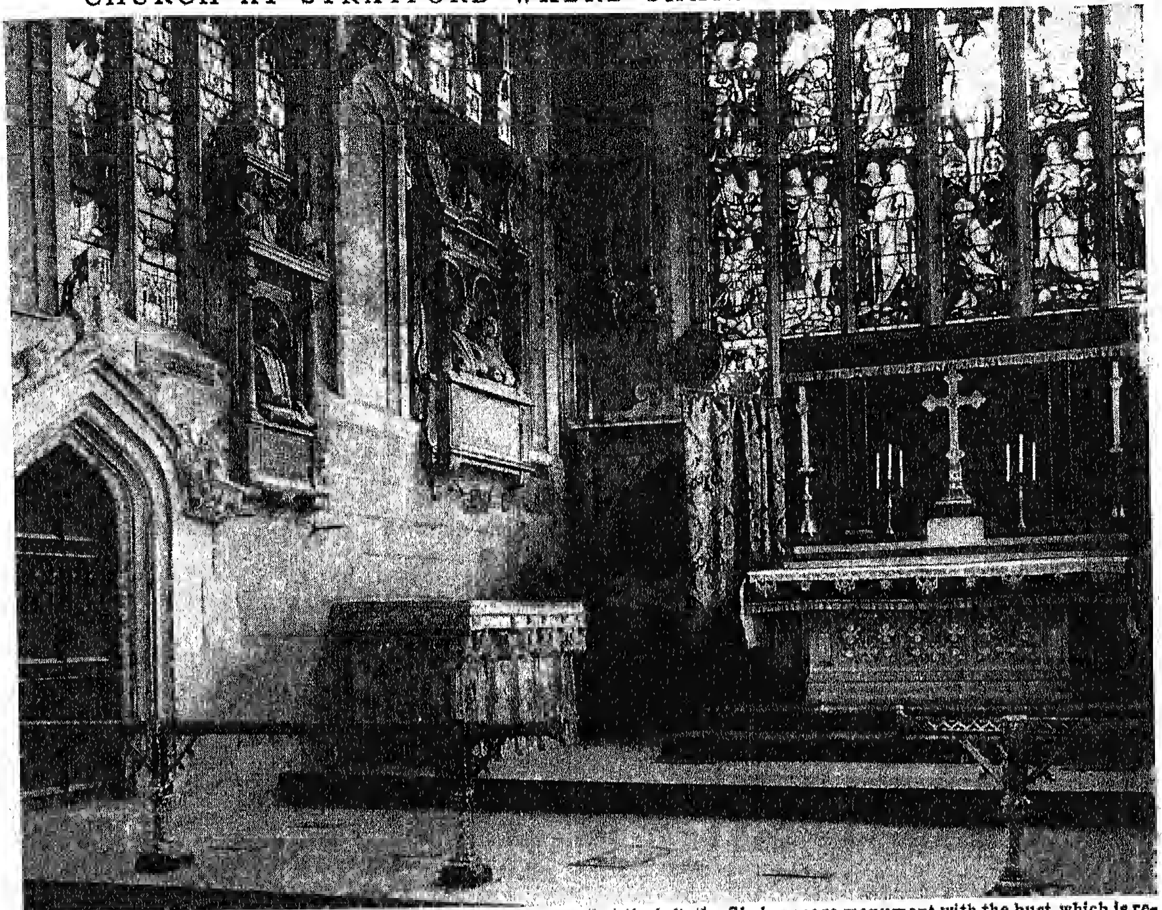
Jonson, who occasionally criticized Shakespeare harshly, nevertheless later wrote a eulogy of him as remarkable for its feeling as for its acuteness. In it he said:

> Leave thee alone, for the comparison
> Of all, that insolent Greece, or haughty Rome
> Sent forth, or since did from their ashes come.
> Triumph, my Britain, thou hast one to show
> To whom all scenes of Europe homage owe.
> He was not of an age, but for all time!
> . . . .
> Sweet Swan of Avon! what a sight it were
> To see thee in our waters yet appear,
> And make those flights upon the banks of Thames,
> That so did take Eliza, and our James!

Death and Burial at Stratford

Shakespeare retired to Stratford, it is supposed about 1610, but did not entirely sever his connections with London friends, who visited him at times. In 1613 the Globe Theater burned. This was no doubt a considerable loss to Shakespeare, but he was still a wealthy man. He shared in the building of the new Globe. A few months before the fire, he purchased as an investment a house in the fashionable Blackfriars district of London. He died three years later, on April 23, 1616, at the age of 52. Two days later he was buried in the chancel of the Church of the Holy Trinity in Stratford.

CHURCH AT STRATFORD WHERE SHAKESPEARE IS BURIED



This view of the chancel of Holy Trinity Church shows, in the wall at the left, the Shakespeare monument with the bust which is reproduced in closer view on page 94. The poet's gravestone is in the pavement inside the rail at the left.

A stone slab—a reproduction of the original one, which it replaced in 1830—marks his grave. It bears the curious inscription, perhaps written by himself:

GOOD FREND FOR IESVS SAKE FORBEARE,
TO DIGG THE DVST ENCLOASED HEARE:
BLESE BE Y^{E} MAN Y^{T} SPARES THES STONES,
AND CVRST BE HE Y^{T} MOVES MY BONES.

On the north wall of the chancel is a monument, consisting of a portrait bust enclosed in an architectural frame, over an inscription in Latin and English, perhaps written by his son-in-law Dr. Hall. This bust and the engraving by Martin Droeshout, prefixed to the First Folio edition of his plays (1623), are the only pictures of the poet which can be accepted as authentic likenesses. Aubrey, an Oxford don, writing 65 years after the poet's death but evidently using information furnished him by the son of one of Shakespeare's fellow-actors, described him as "a handsome, well-shaped man, very good company, and of a very ready and pleasant smooth wit."

Shakespeare's will, which survives, bequeathes most of his property to Susanna and her daughter, leaves small mementoes to friends, and mentions his wife only once, bequeathing her his "second-best bed" with its furnishings. Much has been written about this odd bequest; but there is little reason to suppose it was a slight. Indeed, it may well have been a special mark of affection, for the "second-best bed" was probably the bed of William and Anne; the best bed was reserved for guests. At any rate, his wife was entitled by law to one-third of her husband's goods and real estate and to the use for life of his chief dwelling-house. She died in 1623.

The will contains three signatures of the poet, and these, with three others, are the only known specimens of his handwriting in existence, unless we accept as genuine some lines in the manuscript play of 'Sir Thomas More' which certain experts believe to be his. The first signature on the will is reproduced here:

He appears to have spelled his name in various ways; his father's papers show some 16 spellings, of which Shakspere, Shaxpere, and Shakespeare are the most common.

The Controversy about His Authorship

The outward events of Shakespeare's life seem so prosaic that many persons have found it impossible to believe that such a man could have been the author of the plays. They cannot accept the idea that a man so industrious, sober, and even middle-class in his ways, steadily accumulating wealth, and providing for his family, could have known such heights and depths of passion. They feel that his contemporaries showed strangely little realization of his greatness. Some believe that the Stratford boy who had so little schooling could never have acquired knowledge of the professions and of the aristocratic sports of hawking and hunting, or acquaintance with the speech and manners of the upper classes.

So, for about a hundred years, there has been a persistent effort to prove that Shakespeare did not write the plays, with many attempts to prove that someone else did. The author most often named was Francis Bacon, and the Bacon-Shakespeare controversy has filled a numerous library of books. After the Baconian theory became less popular, the Earl of Oxford and other men were brought forward, until nearly every famous Elizabethan has been named as author. Some theorists have even maintained that "Shakespeare" is merely a pseudonym for a syndicate of poets.

But such persons have not satisfactorily explained the fact that Shakespeare's contemporaries—Meres, for example, in 1598 and Jonson in 1623—did recognize his worth both as a man and as a writer. And to hold that an obscure boy could not have become the Shakespeare we know is to ignore the mystery of genius. His knowledge, remarkable as it is, is not in general of the kind acquired in school. It is precisely the kind a literary genius acquires, because such a genius is insatiably inquisitive. For proof of this, we need but turn to the example of other writers whose educational opportunities were less than those of Shakespeare.

Few scholars take seriously any of the many attempts to deprive Shakespeare of authorship. They feel that the plays are marked by a style so individual and inimitable that any competent critic can recognize it; and this style is found nowhere else. It would be hard to name anyone less likely to have written them than Bacon, who, great as he was, was certainly no poet.

Is Shakespeare's Life Revealed in His Sonnets?

The desire to know more of Shakespeare's private history has led to an unceasing search in his plays for hints, without much result. He left, however, 154 sonnets—published probably against his wishes in 1609—in which many readers believe he revealed an important episode of his life. These have consequently attracted more attention than anything else he wrote except 'Hamlet'. They are among the greatest sonnets in the language, but popular curiosity about them has been largely due to their supposed autobiographical significance. They shadow forth, rather than tell, a story which, in briefest form, is this: the poet loved a younger man of noble rank, who wronged the poet by stealing the affections of a mistress and by transferring his friendship to another poet, but was forgiven.

Whether these incidents ever happened or are only a dramatic invention makes the "problem of the sonnets." This has been complicated by the attempt to discover the originals of the friend, the "dark lady," and the "rival poet." One faction tries to prove that the friend was William Herbert, Earl of Pembroke; another, Henry Wriothesley, Earl of Southampton. Others have other theories. The best opinion is that the sonnets are so impassioned and so detailed that they appear to refer to some actual history, but they cannot be proved to do so.

Shakespeare's few other non-dramatic poems have only a literary interest. They are 'Venus and Adonis' and 'The Rape of Lucrece', typical Renaissance works of gorgeous imagery, lusciousness, and pagan spirit—obviously the work of a young man; a few other sonnets, a poem or two, and the 60-odd songs scattered through the plays. These last exhibit the finest Elizabethan qualities in their spontaneity, melody, and entrancing rhythms.

Shakespeare as an Elizabethan

The reign of Queen Elizabeth (1558–1603) was the period when the English Renaissance came into full flower. In this period of transition from the Middle Ages to modern times, there was a change from an absorbing interest in heaven and an after life to an ardent interest in nature and man. It was an age of curiosity, activity, and courage. Men boldly explored the past, the earth, and their own minds.

At its best the period showed an intellectual and physical daring that produced such adventurers as Raleigh and Drake, such statesmen as the Cecils, such scholar-gentlemen as Sidney, such dreamers as Spenser, such philosophers as Bacon, such scientists as Gilbert, and such poet-psychologists as Shakespeare. At its worst it was extravagant and brutal.

Its extravagance showed in its manners, dress, and speech, which were elaborate and ornate. The language was growing like a weed and made all sorts of wild growths. And yet for this very reason it was suited to poetry. Shakespeare's vocabulary was the largest employed by any English author; but its size is less remarkable than its expressiveness. It may be said that English idiom reached its peak of raciness and strength between 1600 and 1610, in the closing years of Elizabeth's reign and the early years of James I, when the King James version of the Bible was being made, when Bacon was writing his 'Essays', and when Shakespeare was composing his great tragedies.

The Elizabethans worshiped learning, but only because it made life more interesting. And they looked upon literature as only one sort of living, and a poor

substitute for action. Like the Greeks, they valued physical education as no less important than intellectual culture. A gentleman should, they thought, be able to ride, fence, hawk, and hunt; should have mastered the many dances then in vogue; and should know how to sing, play an instrument, and write verses. The age was extremely musical; indeed, it saw the beginning of modern music. The Elizabethans loved the open air, field sports, gardens, birds, and flowers. Their sports were often brutal, and their hotheadedness reminds one of the Italians they admired. One does not have to read far in Shakespeare to realize how fully, in all these respects, he was a child of his age.

Among the English middle class then, as always, sturdy morality and sobriety were combined with independence of spirit. The citizens of London were tenacious of their rights and did not hesitate to defy the court if it became too arrogant. But courtiers, citizens, and common people found common ground in their love of the stage, pageantry, and poetry. The nobles encouraged and supported the actors; they provided the processions, masques, and tournaments which the public loved to watch. The extravagance of the court was proverbial. They vied with one another to excel in dress, building, lavish entertainment, and flattery of the Queen.

The Queen as a Symbol of the Age

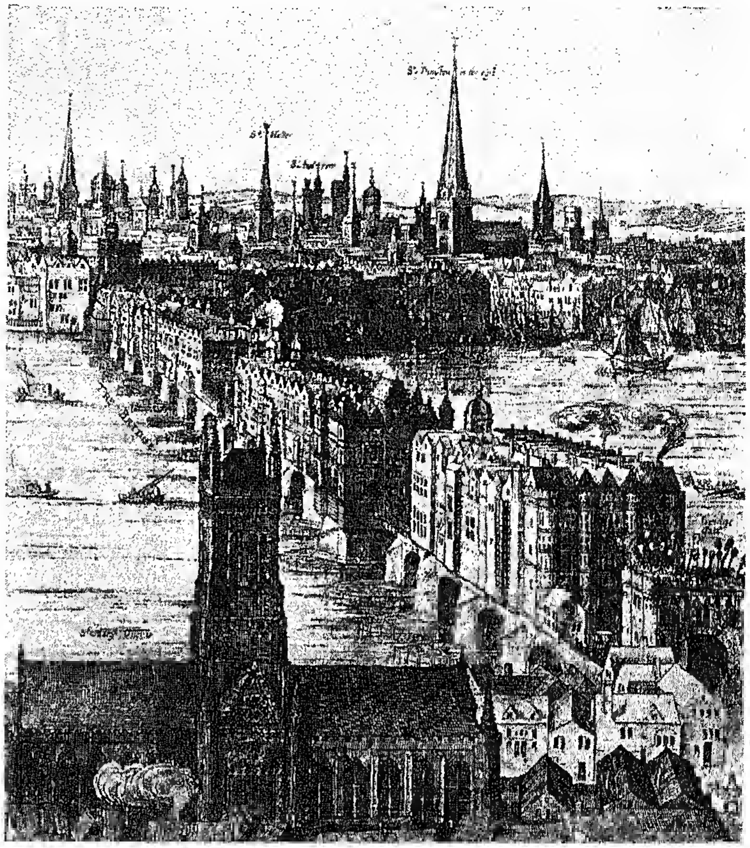
The Queen herself was the symbol of the glory of England. For her people, Elizabeth was the embodiment of beauty and greatness. Exactly how great or little she actually was historians are not agreed, but for her people she was Gloriana, the Faerie Queene—Juno and Venus and Minerva in one. (*See* Elizabeth, Queen of England.)

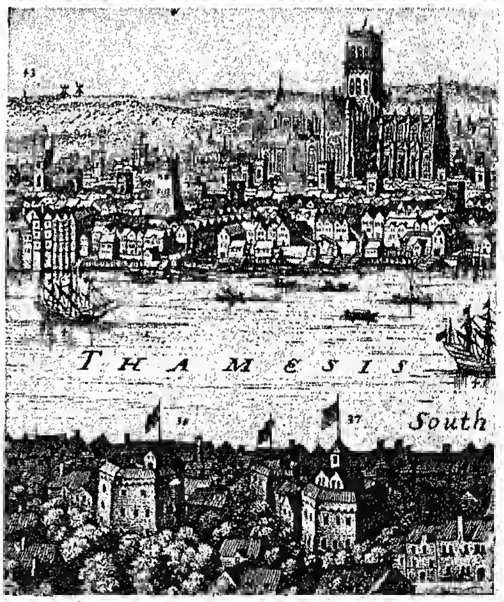
During her reign, in spite of plague and other calamities, the country grew fast in wealth and influence. Although moralists rebuked the laxity of morals, the oppression of the poor, and the greediness of the nobles, England was still Merry England. It had the best inns in Europe, the richest and most varied diet, and its people were the best clothed and housed. The Queen also typified the position of women, who were free and who, like her, conversed, jested, and even cursed as the equals of men—just as they do in Shakespeare's comedies.

The Drama in the Elizabethan Age

The defeat of the Spanish Armada in 1588 had a profound effect upon the popular spirit, convincing sober men that England was great and the populace that any Englishman could beat six Spaniards. During the decade 1590–1600, the nation became intensely interested in its own past, and the

THE LONDON OF SHAKESPEARE'S DAY





The chief theater district, Bankside, was on the south bank of the Thames. Theatergoers reached it by rowboat or by crossing London Bridge. The upper picture (engraved in 1616) shows this famous bridge and the high buildings which covered it. The lower picture (engraved 20 years later) shows Bankside in the foreground, with the Globe Theater (numbered 37) and the Bear Garden (38).

playwrights catered to this patriotism by writing chronicle or history plays—great sprawling dramas telling the stories of the English kings. Shakespeare wrote ten of them. And the same interest spread to the history of the nations of the Continent, ancient and modern.

When Shakespeare arrived in London, he found the theater and drama in a lusty condition. The love of the stage amounted to a craze, and plays were shrewdly calculated to appeal to the popular taste. The popularity of the theater resembled, in fact, that of the motion picture today. The first public playhouse had been opened a few years earlier, in 1576. The group of talented men known as the University Wits had already developed new types of plays out of old forms and had learned much about what the public wanted.

The dramatic authors of the time were practical men, bent on making a living. They might boast of their learning, but they were more eager to fill the theaters than to please the critics. The consequence was that the drama, almost from the start, was a popular art and not, as in France, a learned and classical art. Shakespeare harbored no fancy notions. He wrote his plays to be acted, not to be read. He worked with his ear close to the ground and he was quick to detect changes in popular taste. He took whatever forms were attracting attention and made them better. He borrowed his plots, perhaps to save time, and even paraphrased passages from other authors.

A theatrical author in those days was likely to be also an actor and producer. He joined a company and became its playwright, selling his manuscripts to it and retaining no personal rights in them. Revision and collaboration were common, perhaps because the demand for plays was so great that it could never be adequately supplied, and such methods saved time. The reason why no manuscripts of Shakespeare—with the possible exception of a scene of the 'Sir Thomas More'—and very few of other dramatists have survived is that plays were written, not to be printed, but to be played. They were, in fact, hardly considered literature at all.

A company of players was a coöperative organization sharing profits. Because its members had individually no legal or political rights, each company sought a patron among the rich nobles, became nominally his "servants" or "men," and received his protection. A company consisted usually of eight or ten men, who took the main rôles and employed other actors as these were needed. Boys took the female rôles, for women did not appear on the stage.

The Elizabethan Theater

The theaters were of two sorts, public and private. The former were usually round wooden structures, with three stories corresponding to the three galleries inside. The private theaters were commonly square, but of the same general design, except that they were entirely roofed over. The pit of the public theaters, corresponding to the modern orchestra, was not roofed. It had no seats and its occupants were slangily called "groundlings" because they stood on the ground. Admission to the pit was usually a penny; admission to the galleries, boxes, and stage cost more. Performances were given in the afternoon.

The main stage of the Globe Theater, for which most of Shakespeare's plays were written, was a platform about 40 feet wide projecting 27 feet into the pit, with a roof of its own. Behind it was a recessed inner stage, which could be concealed by curtains. Above the inner stage was a second inner stage, with curtains and a balcony; and above that, a music room, the front of which could be used for dramatic action. On top of the stage roof was a structure called the "huts," with hoists for raising and lowering actors and properties. On days of performances a flag was flown from a turret above the huts.

It is often said that the Elizabethans used no scenery, but there is reason to believe that their stage was by no means bare. We know that they used "heavy properties" and hangings and that their settings were often elaborate. Their costumes, which were as a rule in the fashion of the time, were sumptuous.

Exactly how the stage was used is still a matter of debate. It is obvious, however, that in general the outer stage was used for outdoor scenes and mass effects; the inner, for interiors and intimate scenes and as a background; the upper, for elevated scenes, as at windows or on walls. All three stages could be used in any combination.

Influence on Shakespeare's Methods

This stage affected Shakespeare's technique in various ways. Perhaps the most important is that it was so free or "plastic" that it permitted a rapidity of changes and of action hardly possible on our stage. 'Antony and Cleopatra', for example, has more than 40 scenes. Another is that the outer stage, projecting into the audience, encouraged oratory; this suggests a reason for the long and impassioned speeches so usual in his dramas. The absence of women actors made the disguises of women as men seem less unnatural than we find them. The absence of stage lighting and of a roof accounts for the multitude of speeches suggesting time, season, and weather. There are more than 40 such references in 'Macbeth'. The intimacy of actor and audience, the mixture of classes in the theater, and the proximity of the "groundlings" to the stage explain why nearly all the plays contain scenes and speeches designed to appeal to all sorts of people—from horseplay to philosophy, from grossness to exquisite poetry.

For this theater Shakespeare wrote at least 37 plays. The chief sources from which he took his plots were Plutarch's 'Parallel Lives of Illustrious Men', Raphael Holinshed's 'Chronicles of England, Scotland, and Ireland', and certain Italian *novelle*, or short tales. A few plays he borrowed from older dramas, and one or two from English stories. But what he did with his borrowings is more important than his borrowing. In brief, if his original gave him what he needed, he used it closely; if not, he changed it, and

his changes are a chief mark of his ability as a playwright.

Shakespeare as Dramatist

Thus far, we have been concerned with the facts about Shakespeare. But when we turn to a consideration of his place in literature, such facts have little to do with our appreciation. Shakespeare wrote his plays to give entertainment; and it is possible to kill our enjoyment of his art by too much attention to his life, his times, and the problems of his text. He can be enjoyed at home or in the playhouse without our knowing any of these things.

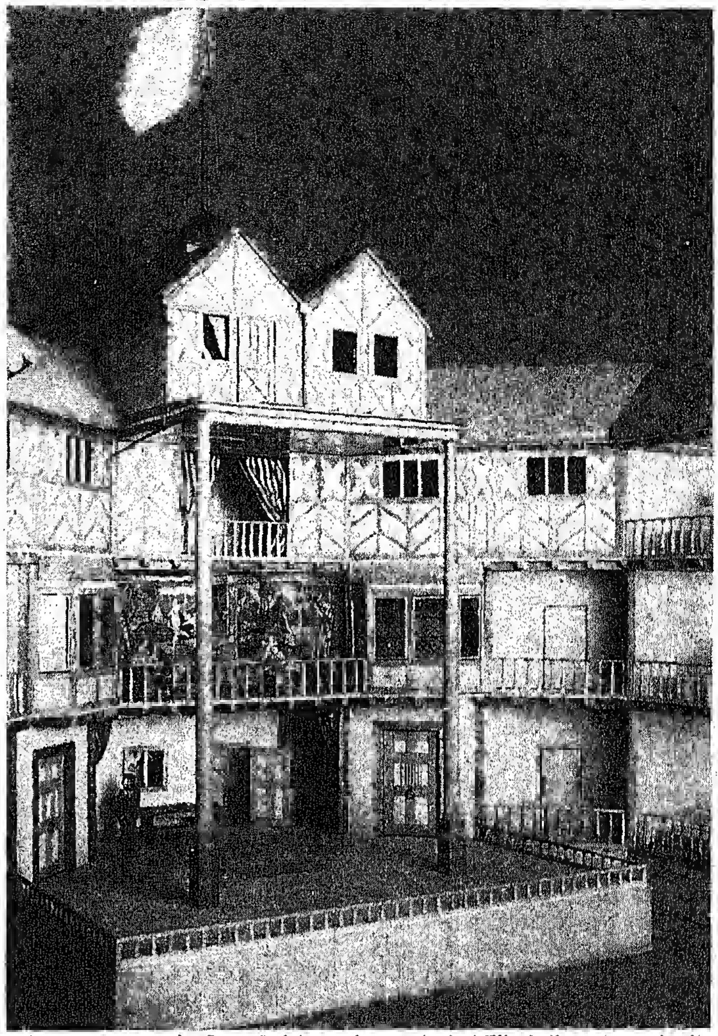
There are difficulties, however, in the way of this enjoyment. He wrote 300 years ago and his language is naturally somewhat different from ours, containing words we may not know. Besides, he wrote in verse, and verse permits an imaginative use of words that taxes the mind of an unimaginative reader. His plays are, moreover, often fanciful; and matter-of-fact persons, used to modern realism, are offended by their improbability. For all these reasons, readers may find him difficult. But perhaps the worst handicap to enjoyment is the notion that he is a "classic," a writer to be approached with awe, to read whom one has to be learned and solemn.

Reading the Plays for Enjoyment

The way to escape this last difficulty is to remember that Shakespeare wrote his plays for the public, many of whom were less intelligent and less educated than we. They looked upon him as an amusing, exciting, and lovable entertainer, rather than as a great poet. If we will but try to read him as they listened to him, for excitement and enjoyment, we shall lose self-consciousness and most of the surface difficulties will vanish.

We must never lose sight of the fact that the plays were written to be performed, not to be read. It is therefore important to see exactly what happens in the plays and why. The more we study his plots, the more we realize that Shakespeare is a masterly playwright. He not only constructed his plays with care but seldom admitted a speech that did not forward the action or develop character or aid the imagination of the spectator. It is well to read the plays twice; first rapidly for the story, and again for details and fuller understanding. It really pays, too, to study his language, because it is truly wonderful in expressiveness and concentrated meaning. An edition that has good explanatory notes is for this reason an aid to the enjoyment of the plays.

THE STAGE OF THE GLOBE PLAYHOUSE



This reconstruction by John C. Adams shows a typical Elizabethan stage with its four-story stagehouse. Action took place mostly on the first two levels.

As for the improbability of his plots, we must remember that he belonged to an age which was romantic and poetic. People had not lost the power of making believe. They did not go to the theater to see scenes like those of real life, but to be carried away into other times and places or into a land of fancy. Today the imaginative reader loves him for the same reason. There were really no such places as his Bohemia or Illyria or Forest of Arden, though the names were real. He has never been equaled in the invention of supernatural creatures—ghosts, witches, and fairies.

And yet Shakespeare's art, like all great art, is realistic in the sense of being true to life. However fantastic his plots may seem, as in 'Lear', 'Midsummer Night's Dream', and 'The Tempest', they are at bottom powerfully and eternally true. However unusual his characters may seem at first, they are often more revealing and instructive than persons in

real life. His Hamlet is more famous than any but a few real persons; his Brutus, Cleopatra, and Macbeth have supplanted in our minds the real men and women they represent.

Characters That Will Live Forever

For the general reader the greatest fascination lies no doubt in his plots and characters. No one has ever excelled him in creating persons who seem alive and three-dimensional, who live in the mind as warmly as one's intimate friends. His greatest glory is, of course, his portrayal of his great heroes, and yet his ability to make minor characters live is quite as remarkable. As a test of his powers of portrayal one might take the fact that he drew more than twenty young women, all of about the same age, the same station in life, and the same social background, and yet made them as different and as lovable as any twenty girls in real life. And the same might be said of his elderly women, men of action, churchmen, kings and villains, dreamers, fools, and bumpkins.

To his contemporaries, Shakespeare was only one of half a hundred playwrights who provided excitement and entertainment. Of these, Ben Jonson, George Chapman, Thomas Dekker, Thomas Heywood, John Webster, John Ford, Philip Massinger, Thomas Middleton, John Fletcher, or Francis Beaumont may at times have seemed his equals. For he played a part in a very vigorous literary movement, so rich in talent that any one member might be obscured. This fact, however, makes all the moro notable his gradual surpassing of his contemporaries and their decline in reputation. Excellent dramatists though they were, they have all but disappeared from the stage and aro read chiefly by students who wish to acquaint themselves with the literary background of Shakespeare.

If wo seek the reason for this enduring appeal of Shakespeare, we shall find that both his knowledge of humanity and his mastery of the art of poetry wero greater than those of any other man. But just as the world took time fully to realize his greatness, so must we. Many men spend their lives reading and studying him, for he is inexhaustible. And yet not much is gained by assuming, as too many do, an attitude of awe and worship toward him. The best way to approach him is the one he would have liked: as a wise, humorous, friendly person, who loved mankind, nature, and poetry.

His Poetic Excellence

As for his poetry itself, it is hard to say anything about it in a few words. One fact is suggestive: no other writer in the world is so quotable or so often quoted. His ability to express thought and feeling in words of beauty or power is unexcelled. There was apparently nothing that he could not fit to words or fit words to. And in all the technical skills of the poet —rhythm, sound, image, and metaphor—he remains the greatest of craftsmen. And, finally, his range is immense, extending from the wildest word play to the sublimest eloquence, from the homeliest speech of common men to the subtlest language of the philosopher.

The meter of his plays is the unrhymed iambic pentameter called "blank verse." This was first used in Italy. It was adopted by English poets in the reign of Henry VIII and developed as a dramatic verse-form by the University Wits, especially Marlowe. From these, Shakespeare took it and perfected it. He, with Milton, was mainly responsible for making it the greatest meter in English. Blank verse is finely adapted for use in poetic drama, because it is far enough removed from prose without being too far removed. Rhymed verse seems too monotonous and artificial; blank verse is more ordered, swift, and noble than prose and yet is at the same time so flexible that it seems almost as natural as prose, if it is written by a master. (*See also* Poetry.)

Examples of His Art

To gain an impression of Shakespeare's power and variety, read such passages as Prospero's speech in 'The Tempest', Act IV, Scene i:

> Our revels now are ended. These our actors,
> As I foretold you, were all spirits, and
> Are melted into air, into thin air;
> And, like the baseless fabric of this vision,
> The cloud-capp'd towers, the gorgeous palaces,
> The solemn temples, the great globe itself,
> Yea, all which it inherit, shall dissolve
> And, like this insubstantial pageant faded,
> Leave not a rack behind. We are such stuff
> As dreams are made on, and our little life
> Is rounded with a sleep.

And then Lorenzo's speech in the last act of 'The Merchant of Venice':

> How sweet the moonlight sleeps upon this bank!
> Here will we sit and let the sounds of music
> Creep in our ears. Soft stillness and the night
> Become the touches of sweet harmony.
> Sit, Jessica. Look how the floor of heaven
> Is thick inlaid with patines of bright gold.
> There's not the smallest orb which thou behold'st
> But in his motion like an angel sings,
> Still quiring to the young-ey'd cherubims;
> Such harmony is in immortal souls;
> But whilst this muddy vesture of decay
> Doth grossly close it in, we cannot hear it.

Then compare other great passages, such as Shylock's "Signior Antonio, many a time and oft," Mercutio's "O, then, I see Queen Mab hath been with you," Richard II's "No matter where; of comfort no man speak," Hamlet's "How all occasions do inform against me," Claudio's (in 'Measure for Measure') "Ay, but to die, and go we know not where," Othello's "Soft you, a word or two before you go," Jaques's "A fool, a fool! I met a fool i' the forest," Macbeth's "We have scotch'd the snake, not kill'd it," and Cleopatra's "Give me my robe, put on my crown."

Note how each speech is characteristic of the speaker and of no one else; each is intensely moving; each is supreme in rhythmical flow and force; and yet all are in the same basic pattern. To make such a comparison is a fine exercise in taste and feeling. To learn these passages by heart is to provide oneself with a friendly and familiar joy in great speech for the rest of one's life.

The Wonder of Our Stage

Soul of the age!
The applause, delight, the wonder of our stage!
My Shakspere, rise! I will not lodge thee by
Chaucer, or Spenser, or bid Beaumont lie
A little further, to make thee a room:
Thou art a monument without a tomb,
And art alive still while thy book doth live
And we have wits to read and praise to give.

—BEN JONSON (1573?–1637)

Great Heir of Fame

What needs my Shakspere for his honored bones
The labor of an age in pilèd stones?
Or that his hallowed relics should be hid
Under a star-ypointing pyramid?
Dear son of memory, great heir of fame,
What need'st thou such weak witness of thy name?

—JOHN MILTON (1608–1674)

Needed Not the Spectacles of Books

He was the man who of all modern, and perhaps ancient poets, had the largest and most comprehensive soul. All the images of nature were still present to him, and he drew them, not laboriously, but luckily; when he describes anything, you more than see it, you feel it too. Those who accuse him to have wanted learning, give him the greater commendation: he was naturally learned; he needed not the spectacles of books to read nature; he looked inwards, and found her there.

—JOHN DRYDEN (1631–1700)

Nature Speaks through Him

If ever any author deserved the name of an original, it was Shakespeare. . . . The poetry of Shakespeare was inspiration indeed: he is not so much an imitator, as an instrument, of Nature; and 'tis not so just to say that he speaks from her, as that she speaks through him . . . every single character in Shakespeare is as much an individual as those in life itself.

—ALEXANDER POPE (1688–1744)

A Forest of Endless Diversity

The work of a correct and regular writer is a garden accurately formed and diligently planted, varied with shades and scented with flowers. The composition of Shakespeare is a forest, in which oaks extend their branches, and pines tower in the air, interspersed sometimes with weeds and brambles, and sometimes giving shelter to myrtles and to roses; filling the eye with awful pomp, and gratifying the mind with endless diversity.

—SAMUEL JOHNSON (1709–1784)

How He Affected Goethe

I do not remember that any book, or person, or event in my life ever produced so great an effect upon me as Shakespeare's plays. They seem to be the work of some heavenly genius.

—JOHANN WOLFGANG GOETHE (1749–1832)

A Royal Stage

The stage in Shakespeare's time was a naked room with a blanket for a curtain, but he made it a field for monarchs.

—SAMUEL TAYLOR COLERIDGE (1772–1834)

Nobility of His Teachings

Shakespeare strengthens virtue, kills selfish and mercenary thoughts, induces sweet honourable actions and ideas, teaches benignity, courtesy, generosity, and humanity.

—CHARLES LAMB (1775–1834)

England's Proudest Boast

In spite of the sad state Hero-worship now lies in, consider what this Shakspeare has actually become among us. Which Englishmen we ever made, in this land of ours, which million of Englishmen, would we not give-up rather than the Stratford Peasant? . . . He is the grandest thing we have yet done. For our honour among foreign nations, as an ornament to our English Household, what item is there that we would not surrender rather than him? Consider now, if they asked us, Will you give-up your Indian Empire or your Shakspeare, you English; never have had any Indian Empire, or never have had any Shakspeare? Really it were a grave question. Official persons would answer doubtless in official language; but we, for our part too, should not we be forced to answer: Indian Empire, or no Indian Empire; we cannot do without Shakspeare! Indian Empire will go, at any rate, some day; but this Shakspeare does not go, he lasts forever with us; we cannot give-up our Shakspeare!

—THOMAS CARLYLE (1795–1881)

Variety of His Characters

Highest among those who have exhibited human nature stands Shakespeare. His variety is like the variety of nature, endless diversity, scarcely any monstrosity. The characters of which he has given us an impression, as vivid as that which we receive from the characters of our own associates, are to be reckoned by scores. Yet in all these scores hardly one character is to be found which deviates widely from the common standard and which we should call very eccentric if we met it in real life. The silly notion that every man has one ruling passion, and that this clue once known unravels all the mysteries of his conduct, finds no countenance in the plays of Shakespeare. There man appears as he is, made up of a crowd of passions, which contend for the mastery over him and govern him in turn. . . . Admirable as he is in all parts of his art, we most admire him for this—that while he has left us a greater number of striking portraits than all other dramatists put together, he has scarcely left us a single caricature.

—THOMAS BABINGTON MACAULAY (1800–1859)

A Treasure for All Time

. . . a thousand years hence a world of new readers will possess a whole library of new books, as we ourselves do, in these volumes old already.

—NATHANIEL HAWTHORNE (1804–1864)

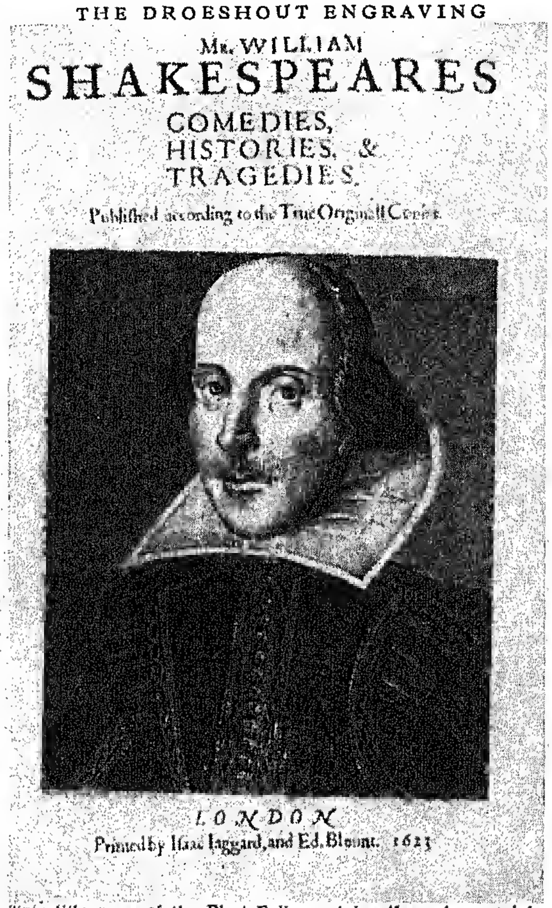
Practical Christianity

I have derived more practical Christianity from reading Shakespeare's plays and seeing them enacted than from any sermon I ever heard preached.

—CHARLES KINGSLEY (1819–1875)

Shakespeare's faults are many, but they are the faults of greatness. His love of words leads him sometimes to indulge in rant and bombast, puns and quibbles; and haste betrays him occasionally into writing nonsense. His less important characters sometimes talk affectedly or tastelessly. Like others of his time, he can be coarse and even gross, and he occasionally shocks the reader by his callousness. But most of his faults can be counted as natural to a writer of his period, which was not ashamed of our animal nature, though at the same time it was in no doubt about our divinity.

THE DROESHOUT ENGRAVING



This title page of the First Folio contains the only certainly authentic likeness of Shakespeare, except the bust on his monument. (Folger Shakespeare Library print.)

How the Plays Came Down to Us

We owe a great debt to the scholars who for more than 200 years have worked over the text of the plays. The reason why they have had to do so is mainly that the plays were badly printed and no original manuscripts of them survive.

In Shakespeare's day plays, as a rule, were not printed under the author's supervision. In fact, when a playwright sold a play to his company, he evidently lost all rights in it and could not sell it to a publisher without the company's consent. When a play was no longer in demand on the stage, however, the players would sometimes make a little money by selling the manuscript, for plays were eagerly read by the Elizabethan public. During plague years, when the theaters were closed, and in other times of financial difficulty, this was especially apt to occur. Sometimes, too, plays were taken down in shorthand, or a dismissed actor would write down the play as well as he could remember it and sell it to a stationer.

About half of the plays of Shakespeare appeared in his lifetime in small, cheap pamphlets called quartos. Most of these were printed from fairly accurate manuscripts, but a few were in garbled form. In 1623, however, seven years after the death of Shakespeare, his collected plays were published in a large, expensive volume called the First Folio. This contains all his plays (except two plays of which he wrote only part —'Pericles' and 'The Two Noble Kinsmen'), as well as the first engraved portrait of Shakespeare. This edition was authorized by the author's old comrades, the King's Players, and consequently has great authority in determining what he wrote. Some of the plays in it were printed from the "good" quartos, and some from manuscripts taken from the playhouse. Some of these manuscripts, we have every reason to believe, were in Shakespeare's own handwriting. Others were later copies. Still others, like that from which 'Macbeth' was printed, were manuscripts which a later dramatist had revised.

By studying the language, stagecraft, handwriting, and printing of the period, and by carefully examining and comparing the different editions, editors of Shakespeare have been ascertaining, as nearly as they can, what Shakespeare actually wrote. They have modernized the spelling and punctuation of his plays, supplied them with stage directions, explained difficult passages, and made the works of the poet easier for the modern reader to understand and enjoy.

Scholars and Their "Detective Work"

But along with the stupendous labor of making a good text has gone another —that of determining the chronology or dates of the plays, to help us see the growth of the poet's genius. For about half of the plays we have no positive indication of the date of composition. The critical labor involved has consisted of an exhaustive examination of the plays themselves for possible indications in them concerning the dates of their composition, a search for evidence on this subject in other books, and the attempt to relate the author's literary work to other events in his life.

The methods of ascertaining the order of the plays are a kind of fascinating detective work, having to do with clues, deductions, shrewd reasoning, and weighing of evidence, external and internal. External evidence consists of actual references in other books; internal, of allusions in the plays to external events, of verse tests, and of a study of the poet's imagery and figures of speech.

The verse tests were suggested by the fact that a poet, in mastering a verse form, such as blank verse,

naturally becomes more and more skilful. It was long ago noticed, for example, that in plays known to be early, Shakespeare used little prose, much rhyme, and certain types of rhythmical and metrical regularity; but that, as he grew older, he used more prose, less rhyme, and greater freedom and variety in rhythm and meter. By tabulating such technical facts in all the plays, scholars have obtained evidence which suggests the dates of plays about which external evidence is lacking. We are thus fairly well assured of the order in which the plays were written. This order is indicated in the accompanying table.

CHRONOLOGY OF THE PLAYS

NOTE: The approximate date when Shakespeare wrote each play is given before the title, the date of first printing after the title. Many of these dates are in dispute, and scholars differ about some of them by as much as ten years. The letters (C), (H), and (T) show whether the play is a comedy, historical drama, or tragedy.

FIRST PERIOD (1590–1594)
APPRENTICESHIP

1590	The Comedy of Errors (C) *1623*
1591	Two Gentlemen of Verona (C) *1623*
1592	Henry VI, Parts 1, 2, 3 (H or T) *1623**
1593	Titus Andronicus (T) *1594*
	Love's Labour's Lost (C) *1598*
1594	Richard III (H or T) *1597*

*In a mutilated version, 'Henry VI' Part 2 was published in 1594 and Part 3 in 1595.

SECOND PERIOD (1595–1600)
GREAT COMEDIES AND HISTORIES

1595	A Midsummer Night's Dream (C) *1600*
	Richard II (H or T) *1597*
1596	Romeo and Juliet (T) *1597*
	The Merchant of Venice (C) *1600*
	King John (H or T) *1623*
1597	Henry IV, Part 1 (H) *1598*
	Part 2 (H) *1600*
1598	The Taming of the Shrew (C) *1607*
	Much Ado about Nothing (C) *1600*
1599	Henry V (H) *1600*
	The Merry Wives of Windsor (C) *1602*
	Julius Caesar (T) *1623*
1600	As You Like It (C) *1623*
	Twelfth Night (C) *1623*

THIRD PERIOD (1601–1608)
GREAT TRAGEDIES AND BITTER COMEDIES

1601	Hamlet (T) (pirated edition) *1603*
	(good edition) *1604* or *1605*
1602	All's Well That Ends Well (C) *1623*
	Troilus and Cressida (C) *1609*
1604	Measure for Measure (C) *1623*
	Othello (T) *1622*
1605	King Lear (T) *1608*
1606	Timon of Athens (T) *1623*
	Macbeth (T) *1623*
1607	Antony and Cleopatra (T) *1623*
	*Pericles, Prince of Tyre (C) *1609*
1608	Coriolanus (T) *1623*

*Perhaps a collaboration.

FOURTH PERIOD (1609–1613)
TRAGICOMEDIES

1609	Cymbeline (C) *1623*
1610	The Winter's Tale (C) *1623*
	The Tempest (C) *1623*
1613	*Henry VIII (H) *1623*
	*Two Noble Kinsmen (C) *1634*

*Perhaps a collaboration.

How Critics Rank the Plays

A recent investigation indicates that nine plays are most read in American high schools, as follows, in descending order: 'Macbeth', 'As You Like It', 'Julius Caesar', 'Hamlet', 'The Merchant of Venice', 'A Midsummer Night's Dream', 'Romeo and Juliet', 'The Tempest', and 'Twelfth Night'. These are all among the finest, and the experience of teachers suggests that they are good ones to begin with.

For the sake of providing a general view of all the plays, however, they are arranged below in numbered groups indicating the order of excellence. This ranking of the plays is the result of three centuries of appraisal, but there is still no unanimity of opinion concerning it. Individual critics have ranked each of the great tragedies as the greatest, and some have considered 'Antony and Cleopatra' and 'Coriolanus' as great as the first four. Similar differences of opinion exist regarding the great comedies. Nevertheless, the arrangement is interesting and instructive.

TRAGEDIES: (1) 'Hamlet', 'Macbeth', 'King Lear', 'Othello'; (2) 'Antony and Cleopatra', 'Coriolanus', 'Romeo and Juliet', 'Julius Caesar'; (3) 'Richard II', 'Richard III', 'Timon of Athens'; (4) 'King John', 'Titus Andronicus', 'Henry VI'.

COMEDIES: (1) 'The Tempest', 'As You Like It', 'The Winter's Tale', 'The Merchant of Venice', 'Twelfth Night', 'Much Ado about Nothing', 'Cymbeline', 'A Midsummer Night's Dream'; (2) 'The Merry Wives of Windsor', 'The Taming of the Shrew', 'Two Gentlemen of Verona', 'All's Well That Ends Well', 'A Comedy of Errors', 'Pericles', Love's Labour's Lost', 'Two Noble Kinsmen'.

HISTORIES: (1) 'Henry IV' Parts 1 and 2, 'Henry V', 'Richard II', 'Richard III', 'Henry VIII'; (2) 'King John', 'Henry VI' Parts 2 and 3, 'Henry VI' Part 1.

SERIOUS PLAYS OR "BITTER COMEDIES": 'Measure for Measure', 'Troilus and Cressida' (remarkable plays, but their reading can wait).

Tests of Greatness

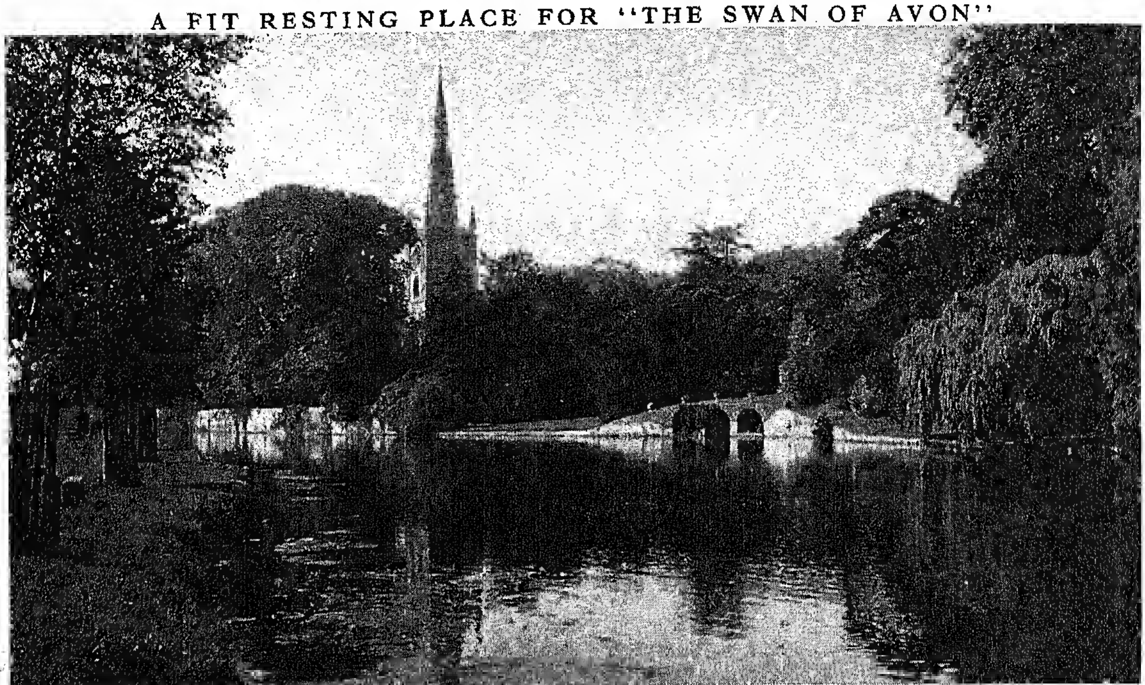
What we mean by greatness is a very complex question. It is probably best answered in the end by feeling. 'King Lear' has a plot that is all but silly and contains faults of taste obvious enough, and yet it has been generally accounted one of the greatest of the tragedies. The reason is that it contains sublime poetry, profound experience, scenes of unutterable pathos, and personages conceived with a grandeur almost unparalleled; and it is besides so complex in detail and yet so grandly simple as a whole that it reminds one of a Beethoven symphony. It remains in the mind like a great natural upheaval—an earthquake or a tornado. It is some such vague but powerful feeling about each of the tragedies, rather than any logical reasoning, that makes experienced critics decide what its rank is. And it is some equally general feeling of richness that decides the rank of the comedies.

The inexperienced reader has to take such judgments on faith. He will read the plays for their stories, persons, and poetic passages, and he may like an inferior play better than a great one. There is nothing to worry about in this. The honest thing is to be true to one's own tastes, and never to pretend to like what one does not. In time, if one continues to read and reread, the reasons why one play is considered better than another will appear.

Shakespeare's Four Periods

In quick review of Shakespeare's entire output, we can say that during his period of apprenticeship—be-

A FIT RESTING PLACE FOR "THE SWAN OF AVON"



Reflected in the placid waters of the Avon River at Stratford is the tower of Trinity Church where Shakespeare lies buried. The thousands who visit this spot every year carry away unforgettable memories of its quiet beauty.

tween his 24th and 30th years—he was learning his craft. He imitated Roman comedy and tragedy and the styles of Lyly, Kyd, Greene, Peele, and Marlowe—his immediate predecessors—and possibly collaborated with Marlowe and others. Since Senecan tragedy or the "tragedy of blood" was in vogue, Shakespeare wrote plays in this style; as he wrote chronicle or history plays when these became fashionable.

With 'Romeo and Juliet' and 'The Merchant of Venice', he had mastered the art of both tragedy and comedy, and with 'Henry IV', the art of history. He essayed the comedy of contemporary local manners only once and then probably without much heart, in 'The Merry Wives of Windsor', for his favorite style was that of romantic comedy. During this second period he shows the ease, power, and consummate mastery of maturity, and the plays are in general sunny, full of fun and joyous poetry.

With Hamlet, about 1601, his tragic period begins and for eight years his thoughts become darker as he probes the problem of evil in the world, at times reaching an almost desperate pessimism. Even the comedies of this time are bitter.

In the last period, cultivating a new form originated by other dramatists, the tragicomedy or dramatic romance, he writes plays of sober coloring but in a mood of reconciliation with life. 'The Tempest' is perhaps the most beautiful and serene of all his plays. At the very end he appears to have returned to collaboration, working with John Fletcher or another, on such plays as 'Henry VIII' and 'Two Noble Kinsmen'—perhaps because he was growing tired.

As we look back over this tremendous accomplishment and try to explain Shakespeare's popularity, not only in England and America, but in other civilized nations, we can only say that he has a magic of speech and fancy which we can feel but not describe.

Some Reasons for His Popularity

His charm is compounded of the "shaping power" of imagination, an incomparable witchery of words, an almost godlike tolerance and sympathy, and a prevailing healthiness of mind. No one else has the variety which has won for him the name of "myriad-minded." No one else has his warmth of humanity combined with uncompromising vision of human villainy and reverence for human heroism.

He recognizes evil, but believes that man can overcome it. As he says, "we are mixtures of good and evil"; and the astonishing reality of his people lies partly in the fact that, like real people, they can be great and yet foolish, bad and yet likable, good and yet faulty. He appears really to have believed that "it takes all kinds of people to make a world," and to have found even fools, knaves, and madmen so fascinating that he would not have voted them out of existence if he could.

Solemn folk have therefore accused him of having no convictions, no social conscience, no general beliefs, no philosophy. They forget that he had something rarer and more precious; an infinite tolerance and charity. We do not know what his religion was, but we must be blind not to see that he loved men and believed in their capacity for nobleness. His greatest creations are painted larger than life and have a super-

human energy and grandeur, but they are in essence symbols of mankind in its greatest passions and powers, whether thinking or feeling, whether good or evil. (For titles of plays treated elsewhere, *see* **Shakespeare** in FACT-INDEX at the end of this volume.)

The Great Shakespeare Collections

The number of books about Shakespeare is stupendous. If it were possible to assemble them all in one place, they would make an array of thousands. The greatest collections are in the Folger Shakespeare Library, Washington, D. C.; the Henry E. Huntington Library, San Marino, Calif.; the British Museum, London; and the Bodleian Library, Oxford University. The Folger (the name is pronounced to rhyme with "soldier"), the greatest of all, was assembled by Henry Clay Folger and bequeathed by him to the trustees of Amherst College to be administered for the use of the American people forever. He provided a $2,000,000 marble building in Washington, which was opened in 1932, and endowed the library for growth and upkeep. The collection consists of books, manuscripts, playbills, prints, paintings, and other materials. Though called a Shakespeare library, it attempts to gather all the books printed in England before 1641, and covers every aspect of intellectual activity from the beginning of the Renaissance to the Commonwealth.

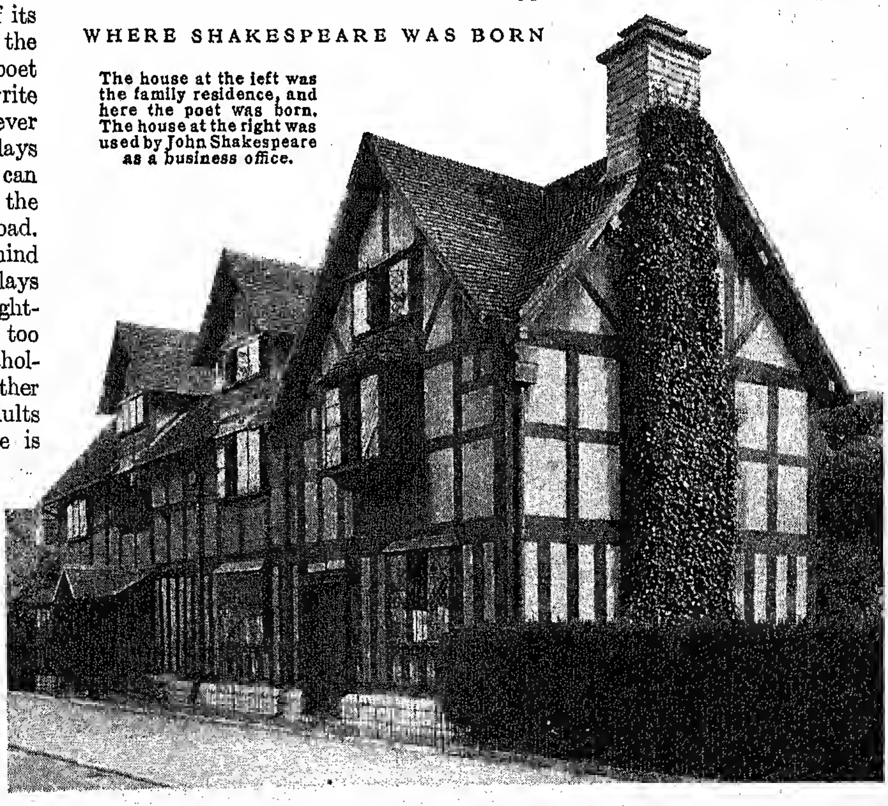
Books About Shakespeare and His Times

Countless children have first become acquainted with Shakespeare through the 'Tales from Shakespeare' of Charles and Mary Lamb. This book is a classic in its own right because of its charming simplicity and the enlightened love of the poet which made its authors write it. Its narratives can never take the place of the plays themselves, but they can lead young readers to the plays along a pleasant road. They serve also to remind older readers that the plays are really a kind of delightful story-telling—a fact too often overlooked by scholars and critics. Another child's book which adults can read with pleasure is John Bennett's 'Master Skylark', which gives an interesting picture of Shakespeare's time. D. H. Madden's 'Diary of Master William Silence' gives the best account of Elizabethan field sports. One of Sir Arthur Quiller-Couch's short stories, 'Shakespeare's Christmas', is worth looking up for an amusing narrative of the moving of the Globe Theater from Shoreditch to the Bankside.

Few of us can visit the great libraries, but we can find a good substitute in the 'New Variorum Shakespeare', which contains the gist of many books. This was begun by Horace Howard Furness (1832–1912), continued by his son, and later came under the editorship of Joseph Q. Adams. The word "variorum" means that this edition gives all important variations of text from the original quartos and folios down. But this feature of the edition is to most readers the least interesting. They will prefer the footnotes, giving summaries of the discussion of textual difficulties, and the appendixes in which are reprinted the sources of the plays, opinions of English and foreign critics, records of acting, costuming, and staging, a bibliography, and many other matters. There is no better way to gain some impression of the talent and learning (and, sadly enough, the stupidity) that have been expended upon the plays than by leafing over one of the volumes.

Most good school editions give all the information necessary to intelligent reading. There are, however, several short introductions that are useful and interesting. One can recommend 'An Introduction to Shakespeare', by F. S. Boas; and 'Shakespeare: the Man and His Stage', by E. A. G. Lamborn and G. B. Harrison. Both contain excellent pictures. A larger book of similar type is 'Facts about Shakespeare',

WHERE SHAKESPEARE WAS BORN



The house at the left was the family residence, and here the poet was born. The house at the right was used by John Shakespeare as a business office.

COTTAGE OF ANNE HATHAWAY, SHAKESPEARE'S WIFE

In the village of Shottery about a mile west of Stratford stands this thatched cottage, famous as the birthplace of Anne Hathaway. It is preserved as a museum and is filled with furniture, ornaments, and utensils of the kind used in Shakespeare's day.

by W. A. Neilson and A. H. Thorndike. More readable is 'A Study of Shakespeare', by H. T. Stephenson. F. S. Boas's 'Shakespeare and His Predecessors' gives an interesting account of the poet's relations to the earlier drama.

Two especially readable books about the Elizabethan period are H. T. Stephenson's 'Shakespeare's London' and 'The Elizabethan People'. H. D. Traill's 'Social England' (Vols. III and IV) contains a mass of information and many curious pictures. Joseph Quincy Adams' 'Shakespearean Playhouses' and A. H. Thorndike's 'Shakespeare's Theatre' are lively and accurate. George Pierce Baker's 'Development of Shakespeare as a Dramatist' is perhaps the best discussion of the poet's craftsmanship.

Of lives of Shakespeare, Sir Sidney Lee's is learned but rather dull; Sir Edmund Chambers' is the most complete and authoritative, but intended for scholars; and Joseph Quincy Adams' is the most readable. A brilliant short biography is Sir Walter Raleigh's in the 'English Men of Letters' Series. Among the many lives which combine fact with imagination, J. D. Wilson's 'The Essential Shakespeare' is particularly interesting concerning the poet's youth and his London. The 'William Shakespeare' of Georg Brandes is somewhat fanciful but shows profound insight.

Books of Criticism and Appreciation

Small books of appreciation and criticism, all calculated to make even indifferent readers interested, are: 'Shakespeare', by John Masefield (Home University Library), 'On Reading Shakespeare', by Logan Pearsall Smith, and 'Prefaces to Shakespeare', by Granville Barker. Barrett Wendell's 'William Shakespeare' is notable for its common sense, and Mark Van Doren's 'Shakespeare' for its exclusive attention to the poetry of the plays.

Girls will be particularly interested in Lady Martin's 'On Some of Shakespeare's Female Characters' and Mrs. Jamieson's 'Shakespeare's Heroines'.

Sir Sidney Lee's 'Stratford-on-Avon' is the most interesting historical account of the town. G. B. Harrison's 'An Elizabethan Journal' (3 vols.), giving excerpts from contemporary books and broadsides, is fascinating to dip into.

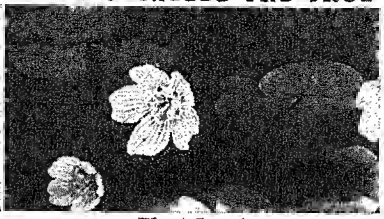
No finer Shakespeare criticism exists than is to be found in A. C. Bradley's 'Shakespearean Tragedy' and 'Oxford Lectures on Poetry'. Also useful for advanced readers are J. W. Mackail's 'Approach to Shakespeare', A. T. Quiller-Couch's 'Shakespeare's Workshop', and E. E. Stoll's 'Shakespeare Studies'.

For the history of the plays on the stage, one should read 'Shakespeare from Betterton to Irving' (2 vols.), by G. C. D. Odell, which is delightful, and 'Shakespeare on the Stage', by William Winter.

Standard reference books which would be of use in any school library are: 'A Shakespeare Dictionary' (of characters), by F. G. Stokes; 'A Shakespeare Glossary', by C. T. Onions; 'A Shakespeare Lexicon', by A. Schmidt; 'A Shakespearian Grammar', by E. A. Abbott; and 'A Concordance to Shakespeare', by J. Bartlett. An extensive bibliography is given in the 'Cambridge History of English Literature'.

EACH OF THESE HAS BEEN CALLED THE TRUE IRISH SHAMROCK


Hop Clover


Wood Sorrel


White Clover

SHAMROCK. "You tell us that there are three gods, and yet one," wonderingly said the natives of Ireland when Saint Patrick was preaching the gospel to them 1,500 years ago. "How can that be?"

For answer the saint bent over and plucked a shamrock growing at his feet. "Do you not see," he said, "how in this wild flower three leaves are united on one stalk, and will you not then believe what I tell you, that there are indeed three Persons and yet one God?"

Historians have relegated many stories about Saint Patrick to the realm of myth, but the shamrock remains the emblem of Ireland, proudly worn by Irishmen the world over on Saint Patrick's Day (March 17). Several plants claim the honor of being the original shamrock (in Irish *seamrog*, meaning "three-leaved"). One of these is the hop clover (*Trifolium dubium*) or lesser yellow trefoil. This resembles white clover, but has yellow flowers and blue-green leaflets. Others are the wood sorrel or oxalis (*Oxalis acetosella*) and the white clover (*Trifolium repens*).

SHANGHAI, CHINA. No city shows better than Shanghai the importance of geographical position. Little more than a century ago it was a fishing village, huddled on the mud flats of the Whangpoo River, about 12 miles from the mouth of the mighty Yangtze Kiang. Today it is the chief port of China and, in normal times, of all the Far East. Yet visitors may wonder how a city arose here; for it is built on swamps, and its climate is oppressive. In winter it is wrapped in damp cold, with a mean January temperature of 38° F., and relative humidity of 70 per cent. In summer it lies listless and steaming with 84 per cent humidity.

But this dank spot was destined to be a world port from the time that China was opened to trade after 1842. For it lay at the entrance to the Yangtze Valley, the heart of central China, with nearly half the population of China. The natural distributing center for coastal trade, it was moreover nearly in the center of world trade, about equidistant from New York and London.

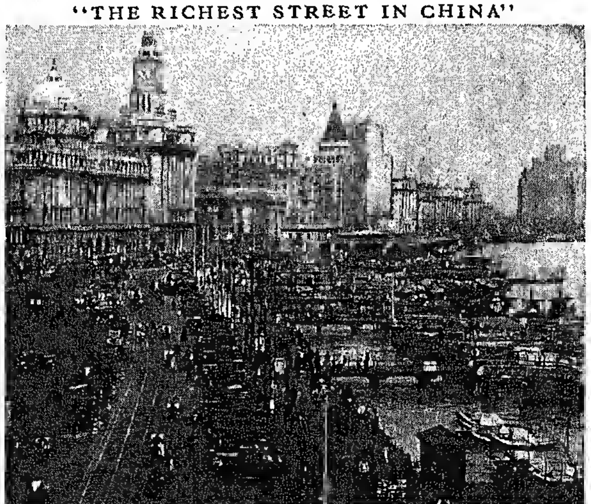
Wise in the ways of trade, England saw these enormous advantages. It forced China to make the village a "treaty port" in 1843, and to permit British traders to build a "concession," a self-governing settlement. French and United States traders soon built others. Together, they made Shanghai the cornerstone of white man's power in East Asia.

Chinese crowded into the new city, and it grew into a sprawling metropolis. It consists of the International Settlement, which borders the Whangpoo; the French Concession, stretching back from the river and nearly encircling the original village, now called Native City; Nantao, adjoining the Native City; Pootung, east of the river; and Chapei, to the north. The foreign concessions—the heart of commerce and business—are clean, modern, and handsome, with tall marble-fronted buildings, parks, and shaded boulevards. But that is only a small part of Shanghai. At the most, white residents were only about 60,000. A very large part of the city is a teeming jumble of narrow, twisting streets, and tenements and huts, reeking with dirt, smells, and unbelievable poverty. Many thousands herd in squat sampans (boats) along Soochow Creek, which winds through the city and empties into the Whangpoo.

The core of the city is the harbor. Engineers work almost constantly to overcome the silting of the Whangpoo. On a typical busy day, ships from scores of nations are unloading cotton, textiles, machinery, and petroleum products. Outgoing vessels carry tea, silk, cotton, rice, hides, bristles, and dried or frozen eggs. In some years this trade totals a billion dollars, and is normally about half the commerce of China.

Industry too developed rapidly, largely because of Shanghai's enormous supply of cheap coolie labor. It has many filatures (silk-

"THE RICHEST STREET IN CHINA"


The Bund, or river front, of the International Settlement is the financial heart of Shanghai. But at the feet of these modern office buildings coolies still plod with their rickshaws and wheelbarrows.

reeling factories), about half of China's cotton mills, and most of the engineering industry. It manufactures many other goods, such as lace, leather, cement, paper, vegetable oils, canned goods, and egg products. Most of its interior trade goes by way of the Yangtze River system, but it is also linked by Soochow Creek to the Grand Canal, some 40 miles distant. Railways connect it with Peiping, Nanking, and Hangchow, and there are also commercial air lines.

For many years Shanghai was virtually untouched by the turmoil of modern China. This security was largely due to foreign control of its government. In 1863 the Americans and the British merged their land to form the International Settlement. This was governed by a council elected by foreign property holders. International police and troops kept order. In the 20th century, Japanese and Chinese were admitted to the council. The peaceful city became a center of missionary work and education. Many schools and colleges were established.

In the 1930's Shanghai became a battleground in the conflicts between China and Japan. After anti-Japanese demonstrations in the native districts, Japan attacked and severely damaged Chapei in 1932. Five years later, when Japan invaded China, Shanghai was besieged. By a tragic mistake, defending Chinese air pilots bombed the International Settlement, inflicting many casualties. All but the foreign concessions then passed into Japanese control. In 1940 England withdrew its troops. The following year Japan gained control of the Settlement council, and the United States removed its Marines. Upon Japan's entrance into the second World War, Dec. 7, 1941, Shanghai was virtually deserted by its foreign population and its vast trade was reduced to a trickle. (Population, more than 3,000,000.)

SHANTUNG (*shän'tụng'*), CHINA. Foreign nations have time and again sought control of rich Shantung province. This gateway to north China is only about the size of Iowa, but its land supports more than 30 million people. They farm chiefly on the alluvial plains of the Hwang Ho, or Yellow River (*see* Hwang River). Some valleys in the treeless highlands of eastern Shantung, which jut out into the Yellow Sea, are also among the most thickly populated districts in the world. The province is rich in coal and iron, and also produces "shantung," a ribby pongee made from silk spun by caterpillars that feed on oak leaves. Each year many Chinese pilgrims come here, for it is the birthplace of Confucius; and near Tsinan, the capital, is the sacred mountain of T'ai-Shan.

The combination of resources, good harbors, and position athwart the main routes to south China have developed several large trade cities. Tsinan, the largest, was the first city in all China voluntarily opened to foreign trade. Tsingtao, also modernized by western influence, is the chief port. Chefoo and Weihsien, large ports, are centers of the hair-net industry. Shantung was dominated by Germany from 1897 until the first World War, and then briefly held by Japan, which again seized it in 1937.

SHARKS. Sharks are the beasts of prey of the sea. Their cruel teeth and their ferocity are their equipment for getting a living. Naturalists set the sharks (and their near relatives the rays) apart in a group of fishes called *Selachians*, the mark of which is that in them the skeleton is not bony, as in most other fishes, but its parts are composed of tough cartilage (gristle). Another notable difference is that the skin of sharks is not thin and protected by a coat of scales, but is a tough hide, covered with sharp, projecting *denticles* composed of dentine with enameled points, like teeth. This skin (called "shagreen") is used like sandpaper for polishing, and, with the denticles removed, makes a durable leather. Sharks are the lowest in rank—that is, simplest in structure—of all the true fishes; they are also among the oldest in history, for their remains are found in rocks of the Devonian period. A few of the most ancient kinds of sharks are still to be found, little changed from their ancestors who swam in the Paleozoic ocean ages ago.

Sharks now exist in an immense variety of size, aspect, and habits. Some, like the small gray dogfish (grayfish), so destructive of fishes and fishermen's nets along the northeastern coast of America, are only three or four feet long; while a certain species of the South Seas attains a length of 40 feet, and in rare instances 65 feet. Some extinct species were even larger. All are more numerous in warm than cold seas, many species belonging wholly to the tropics.

Sharks may be divided into two groups, on the basis of their feeding habits. The ground sharks feed near the bottom, but not in very deep water. Other sharks remain near the surface and capture their prey there. The former are blunt-headed, sluggish, and harmless (to us), prowling about in search of shellfish, sea-anemones, and the like, on which they feed. Their mouths are lined with rounded blocks of a hard substance called "pavement teeth," enabling them to crush and grind the hardest mollusk's shell or toughest crab. This class is the fewest in number and most ancient in character of all Selachians.

The Eating Apparatus of the Shark

The great majority of sharks are surface hunters, and swift and powerful swimmers. Their mouths do not lie at the end of the usually pointed snout, as in other fishes, but some distance back of it on the underside of the head. These mouths are large and furnished with thin sharp-pointed cutting teeth, often notched along the edge, so that the row of them looks and acts like a curved saw. In many sharks these teeth exist in several rows, one behind the other, right around the mouth; and when those in the front row are broken or fall out, the next row moves forward to take their place. Muscles of enormous strength work these horrid jaws; so that it is not surprising to learn that a small shark will chop a stout fish into pieces, or that a big one may bite a man's leg off at one stroke. The underside position of the mouth of

THE RAVENOUS BLUE SHARK, TERROR OF THE SEA

The Blue Shark (*Prionace glauca*) is a common surface shark of the open seas, which follows ships on their voyages for weeks, collecting especially about whaling vessels to devour the carcasses of whales. It is deep blue above and white underneath and more slender and graceful than most other sharks. This picture of a female shark with its young is from a group in the American Museum of Natural History, New York.

course usually induces the shark to turn over when seizing a victim at the surface. The momentary delay thus caused has saved many a life. Pearl divers sometimes carry knives and stab the monsters as they roll over with open jaws. The normal feeding position, however, is mouth down.

Sharks have good eyes and noses—it is believed they can follow a line of scent in the water; but they hear little, if anything, to aid them in their hunting. One big slender fellow (the "hammer-head") has his head so broadened by two big side-lobes that it resembles the head of a hammer. Another, the "thresher," has a very long tail with which it lashes about in a school of fish until dozens of them are killed, which it then swallows at leisure. The dangerous man-eaters are mostly denizens of tropical seas and are often only nine or ten feet long. But some of the worst may very rarely wander northward, so that we hear now and then of a bather seized or attacked even in North American waters, as happened a few years ago on the New Jersey coast.

The young, produced annually, are few, and in many species are born alive. In others they come from eggs that are encased in tough and leathery envelopes. These usually bear stringy appendages that curl like tendrils about seaweeds, and so prevent the egg from drifting ashore before it hatches. These egg-cases—some of which are oblong while certain others are twisted with a spiral cone—and the similar ones of the rays are often cast up empty on the beach, and are called "sea purses."

Sharks are hunted, especially in the waters of the Far East, for the sake of the oil in their great livers, and also for the shagreen. Their flesh is used as food. Among the most common families of sharks are the following: hammerhead, *Sphyrnidae;* threshers, *Alopiidae;* tigers and "man-eaters," *Galeidae;* dogfishes, *Squalidae.*

SHAYS' REBELLION. The most important of all the disturbances in the "critical period" following the American Revolutionary War was Shays' Rebellion of 1786–87 in western Massachusetts. For six months part of that state was in armed revolt against the constituted authorities.

Among the things objected to by the agitators were the heavy taxation on land, the cost of law proceedings, the high salaries paid to state officials, the oppressive rulings of the courts, and the aristocratic character of the state senate. It was one of the first notable movements of democracy against aristocracy and class privilege in the history of the United States. In several towns the courts were hindered from sitting by armed mobs. The Supreme Court session at Springfield was broken up by Shays and his followers, in spite of the presence of the militia. Some concessions were made by the legislature; but the agitation was not checked until the militia fired upon an expedition which Shays was leading against the Federal arsenal in Springfield. The followers of Shays then fled, for the most part, from Massachusetts. Fourteen of the leaders were condemned to death for treason, but were pardoned. Daniel Shays himself was an honest and well-meaning man, and he was later pensioned for his services during the Revolutionary War.

This rebellion was one of several disturbances in different states growing out of the unsettled financial and political conditions following the Revolutionary War. It aroused grave apprehension on the part of intelligent people and hastened the movement for an adequate constitution. Leading men felt that there should be formed at once a central government strong enough "to ensure domestic tranquillity." Just grievances should be remedied, but, as Washington put it, "we should have a government by which our lives, liberties, and properties may be secured."

The ANIMAL FRIEND that GIVES US HIS WOOLEN COAT

SHEEP. There are few animals more useful to man than the sheep, and many primitive peoples would find it very hard, if not impossible, to exist without it. The sheep was among the first animals to be domesticated—perhaps it was the very first; and flocks of sheep were found in many parts of Europe and Asia before the dawn of history. The warm fleecy pelt of the sheep provides primitive men with garments for winter; its skin when properly dressed makes leather for many purposes; its wool is woven into cloth of many varieties; it yields sweet nourishing milk; and its flesh, known as lamb and mutton, is one of the finest of meats.

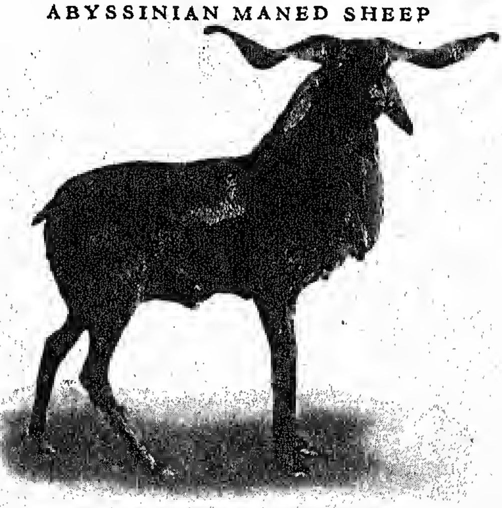
In the wild state sheep are found only in mountainous regions of the Northern Hemisphere. Every group of mountains in Asia possesses one or more species of sheep peculiar to it, but Europe, Africa, and America possess only one species apiece. Wild sheep are never found in lowlands. They ascend mountains sometimes to heights where no other animals except goats are found.

Sheep and goats are closely related to each other, and in the wild state are not easily distinguished by their outward appearance. Sheep differ from goats in the possession of a flat forehead, triangular horns, and no beard; they also have a tear-bag or pit beneath the inner corner of the eyes, which goats lack.

Clever Things Wild Sheep Do

Sheep live in flocks and follow a leader, usually an old ram, as the male sheep is called. They are very timid and flee at the approach of danger, but they can fight, and a large ram will even at times contest with a bull. Ewes, as the females are called, frequently charge dogs that threaten the lambs. When two or more ewes with lambs are together and are attacked by a dog, the lambs follow one of the ewes while the remaining ewes attack the dog. The dog easily dodges the charges of the sheep, but while he is so engaged the ewe and the lambs escape.

ABYSSINIAN MANED SHEEP

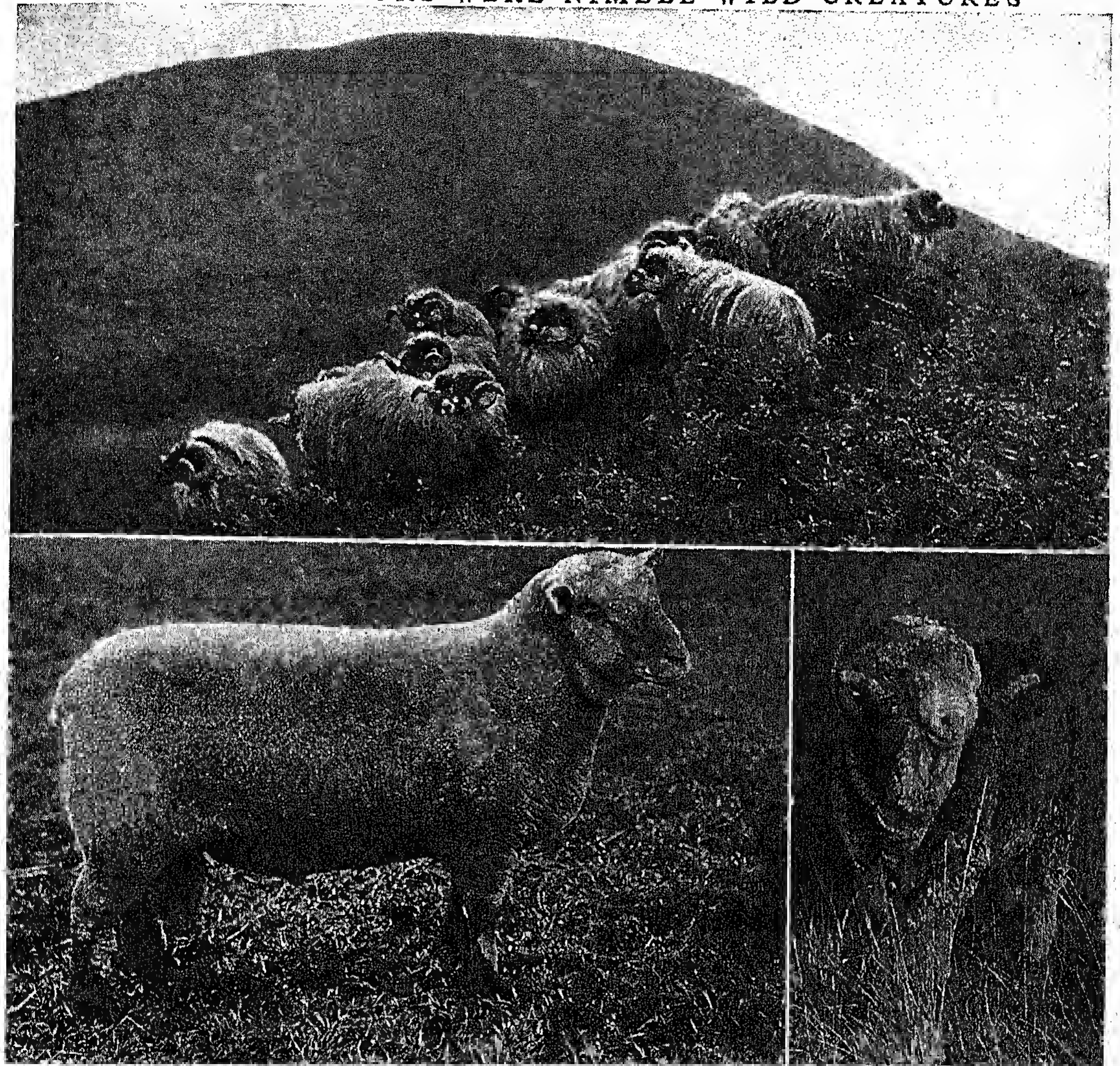


Long hair instead of wool and a longish mane distinguish the Abyssinian breed of sheep. The ram has those long spiral horns.

Domestication has reduced the sheep to entire dependence on man for food and protection. The timidity and cowardice of a flock of domestic sheep is pitiful. A sheet of paper blown by the wind or a clap of thunder will throw a large flock into panic. A fire in a sheepfold usually destroys most of the sheep, since all efforts to drive them out are futile. Even after they have been driven out they are almost certain to run back into the burning building unless prevented from doing so. The lambs, one or two at a birth, are born in the spring, and are capable of following the mother soon after birth.

The bighorn, or Rocky Mountain sheep, of North America is one of the largest varieties of wild sheep (*see* Bighorn). There are several allied species, some of them in Asia. It seems probable that all the wild sheep in Asia and America are closely related, although there are great differences in size and color. The mouflon, the only representative of the sheep family native to Europe, is found on the islands of Corsica and Sardinia. The aoudad, or Barbary sheep, is found in northern Africa, in the Atlas Mountains. It is a large animal, resembling the goats. It has large horns and a manelike growth of long hair on the breast and forelegs. The argali of Mongolia, whose

THEIR ANCESTORS WERE NIMBLE WILD CREATURES



Like clay in the hands of the potter, the wiry, agile, graceful Wild Sheep has been molded to suit human convenience—into the *many woolly, short-legged, clumsy* breeds of Domestic Sheep. *Above is a group of* Scotch Blackface Sheep, *which make excellent* mutton but produce an inferior grade of long, coarse, hairy wool. Below, to the left, is the aristocratic pure-bred Sussex or Southdown, *with its fine short fleece.* *On the right is a Merino ram.* The Merinos are not good mutton-producers, but are considered the greatest wool-producing breed in the world.

enormous spreading horns are a wonder to all beholders, and the "Marco Polo sheep" of the Pamir plateau, whose horns though less massive have a wide spread, are the largest members of the sheep family. The latter gets its name from the famous Venetian traveler of the 13th century, who first described it.

There are several other varieties of wild sheep in Asia, such as the sha or urial, which has a wide range in southern Asia; the burrhel or blue sheep, which is found in the Himalaya Mountains; and the sair whose range is in the Altai Mountains. The burrhel possesses many points, particularly its smooth horns, in common with the goats and seems to be a connecting link between the goats and the sheep.

The origin of the domestic sheep is unknown, but it is almost certain that several, and perhaps many, varieties of wild sheep were tamed, and that the modern varieties of domestic sheep are the result of cross-breeding. However this may be, it is noteworthy that the domestic sheep bear little resemblance to any of the existing wild species. For example, most of the domestic breeds are hornless, though some have developed four and even eight horns, and nearly all bear wool instead of the coarse hair of the wild sheep.

The commonest and best known of the domestic breeds is the Merino, which originated in Spain in the 15th century. It is famous for the large quantity

and fine quality of wool it produces. The Merino has been used to improve most, if not all, of the other European short-wool breeds.

In the beginning of the 19th century Merino rams were imported into America, often at fabulous prices, and the flocks gradually spread westward over the fertile lands of the Great Lakes region, and southward to the Ohio. When the land in this region became too valuable to make the sheep industry profitable at the prevailing prices of wool, large flocks were established throughout the west, from Montana to Texas, and over the Rocky Mountains to the Pacific coast. More than two-thirds of the sheep of the United States are found west of the Mississippi. Since 1910 the number of sheep in the country has considerably decreased, despite the great advance in the price of wool and mutton.

The Best Wool in All the World

The American Merinos produce the best wool in the world, and for many years this breed predominated, but gradually the demand for a better mutton-producing sheep than the Merino resulted in the introduction of various English breeds. Among these the Cotswold was long a favorite, but many other varieties were imported from time to time, and flocks of Southdowns, Shropshires, Hampshires, and Oxford Downs are now found in many parts of the country. They produce wool of medium and long fiber. The "improved Leicester," developed in England, is the progenitor of most long-wool breeds, such as Lincolns and Cotswolds.

The Delaine Merino, from which the fine Delaine wool is derived, is an American product; the breed was developed in western Pennsylvania and eastern Ohio. "Saxony," another popular wool of excellent quality, is derived from Merino sheep which were introduced into Saxony from Spain. The Rambouillet breed, which originated in France and is a descendant of the Spanish Merino, is larger than the Merino and has recently become popular with American sheep-breeders. The Cheviot is a Scottish mountain sheep producing a medium-length fine wool.

The fat-tailed sheep, found in many parts of Africa and Asia, is remarkable for the quantity of fat which accumulates in its tail; in some instances the tail weighs from 50 to 80 pounds. The shepherds fasten a board to the underside of the tail, and sometimes attach wheels to the board to enable the sheep to carry its tail without injury. The fat is highly esteemed as a delicacy and is often used instead of butter. The new-born lambs of other Asiatic sheep, such as the Astrakhans and Karakul breeds, have a very fine wool twisted in spiral curls which is in high demand as fur.

The chief sheep-raising countries of the world are Australia, Argentina, Russia, the United States, South Africa, India, the British Isles, Uruguay, New Zealand, and Spain. (*See also* Wool.)

Sheep belong to the genus *Ovis*, of the family *Bovidae*. The domestic sheep is *Ovis aries*.

SHEFFIELD, ENGLAND. All over the world "Sheffield" means fine cutlery, such as knives, razors, scissors, surgical instruments, together with mathematical instruments, files, saws, and engineering tools of all kinds. Heavy steel, too, is manufactured there—armor plate, rails, engines, machinery, guns and shells—and cast-iron articles, such as stoves and grates, as well as silver and brass ware. Next to the mayor, the highest dignitary in town is the Master Cutler of the ancient Cutler's Company, which exercises jurisdiction over trademarks on metal goods and over all persons in business in the district of the West Riding of Yorkshire, in which Sheffield is situated. The famous "Sheffield plate" (silver) is no longer manufactured, the process having been abandoned in favor of cheaper methods.

Sheffield's preëminence in the steel industry is due in part to its situation in the Yorkshire-Derbyshire coal field; yet iron was smelted with charcoal in the district probably in Roman times—certainly by the time of the Norman Conquest—and Sheffield blades were famous long before "pit coal" was used in the manufacture of iron and steel. The Miller in Chaucer's 'Canterbury Tales' carried a "Sheffield thwytel" or knife. It was a Sheffield man, Benjamin Huntsman, who in 1740 introduced the process of making crucible steel from bar or blister steel, which is still used in making Sheffield fine cutlery. Henry Bessemer established his first steel works in Sheffield, by the aid of Sheffield capital, and much Bessemer steel is still manufactured there.

Like some of the Pennsylvania steel towns, Sheffield is smoky and dirty, but it is delightfully situated at the base of hills on the river Don, a tributary of the Humber. Its most interesting public building is St. Peter's Church, originally built in Norman times and burnt during the wars of Edward III with the barons, but rebuilt; the oldest standing part, the tower, dates from the 14th century. Sheffield University, founded in 1905 by a local steel manufacturer, comprises, besides the departments of medicine, arts, science, commerce, etc., a flourishing technical school with metallurgical laboratories and shops. Population, about 510,000.

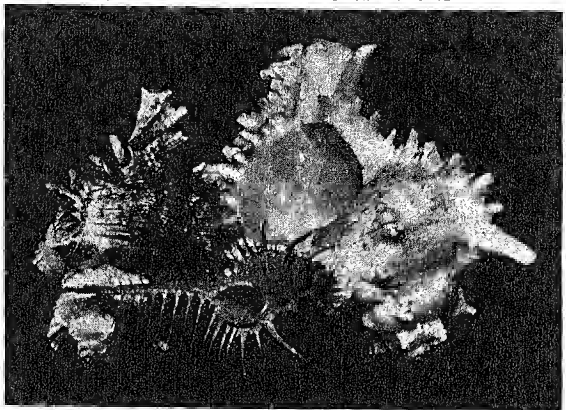
SHELL. Among the many things which make the seashore a place of wonder and delight are the shells, of the most curious and interesting shapes, with which it abounds. Some, washed up by the tide, are empty; but others contain the living tenants, which often rival the shells in interest.

But shells are not confined to the seashore. They are found in all parts of the ocean, sometimes buried in the mud and ooze of the ocean bed, or floating airily on the surface of the water a thousand miles or more from shore; and the dim quiet of the Arctic waters and the brilliant shimmer of the tropic seas alike conceal their millions of interesting creatures. Nor is it necessary to go to the sea for shells, for they abound in fresh-water ponds and streams and on land. They are even found in the desert beds of

dried-up seas, on lofty mountains, and far down in the depths of the earth, giving their mute witness to the life of long-past ages.

Shells as we know them are the coats of armor that mollusks and other animals form to protect themselves. The shell is composed of substances secreted by the glands of the animal's back. It consists largely of carbonate of lime, which is the basic material of limestone, chalk, and marble; and lime is often obtained commercially by burning piles of shells. As the animal grows in size, its shell increases in thickness and extent. The lines of growth are usually clearly marked by the ridges running parallel to the outer or free edge, as in the oyster and clam. The other ridges and protuberances on a shell are caused by corresponding projections on the "mantle," or muscular tissue which grows from the back. (*See* Mollusks.)

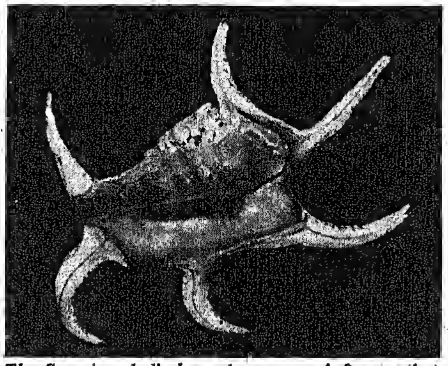
THE BEAUTIFUL MUREX



These shells are from mollusks of the *Murex* genus, remarkable for the beauty and variety of their spines and still more so for the fact that some of the animals yielded the famous "royal" or "Tyrian" purple of the ancients.

The Shell Creature's Triple Coat

The mollusk shell consists of three layers. The outer surface is covered with a thin layer of hornlike material which contains no lime. Beneath this is a layer of very small prisms of carbonate of lime. Lastly, forming the internal layer, is the nacre, or "mother-of-pearl," composed of alternate layers of carbonate of lime and a horny substance arranged parallel to the surface. The free edges of these layers refract the light and thus produce the beautiful iridescent appearance which we prize so highly. The outside of the shell may be white, black, brown, tan, purple, red, or rose, but usually some pattern combining several colors, tints, or shades. The color of the interior is usually paler and more delicate than the exterior, and often it is splendidly prismatic. Shells of the tropics are usually more highly colored than those of temperate zones.



The Scorpion shells have long curved fingers that make them look like the animal for which they are named.

When you look at a collection of shells you are amazed at the infinite variety of shapes represented. Many of them so closely resemble other natural objects or objects of human invention, that they are known as "miter," "harp," "helmet," "top," "razor," "turban," "cone," "basket," "lamp," "frog," "trumpet," "ear," and "slipper" shells. Most are marked with ridges, folds, frills, or spines, corresponding to the growth or structural peculiarities of the animal that lived in them.

But despite the great variety of these forms, you will soon notice that they nearly all fall into one of two great groups—those having a shell in one piece, like the snails, and those having a shell in two pieces hinged at the back, like the oysters and clams. The one-piece shells are called "univalves" and the two-piece shells "bivalves." All the land shells are univalves, but the shells found in the water may be either univalves or bivalves. Besides these two great classes, there is another kind which is much less common, in which the shell consists of eight overlapping plates connected by a leathery girdle. These "coat-of-mail" shells, the chitons, are found wholly in salt water. They cling to the rocks with extraordinary force, and when they are dislodged they promptly curl up like a pill bug, and must be put in salt water or on a moist surface before they will relax.

Among the common bivalves found on or near the seashore are the oyster, clam, mussel, scallop, cockle, razor shells, and the teredo or shipworm. All of these are mollusks, but other interesting bivalves which are not mollusks also live near the shore, usually in deep water. These are the "lamp shells," or brachiopods, which are really shelled worms.

Lamp shells are among the oldest of animal groups. Millions of years ago they were more abundant than now, but in structure they are nearly the same as then. The larger of the two valves resembles the bowl of an ancient lamp, and the circular hole at one end seems to be made for a wick. But the hole is really used to help fasten the animal to some anchorage, for through it runs a long stem. Lamp shells vary in size from two inches to a sixteenth of an inch in length. In color they are waxen white, brown, or brilliant crimson.

The largest of the shells is the giant clam of the Indian and Pacific Oceans, which grows to be from two to three feet in diameter and sometimes weighs four hundred pounds. Single valves of these shells are sometimes used as receptacles for holy water at

the doors of Catholic churches. So hard do the shells become that the natives of the Caroline Islands hew axes out of them. Divers for pearls and sponges are said to have been trapped by this great shell, and to have cut off hand or foot as the only way to escape drowning.

Most of the univalve shells are more or less conical in shape, though sometimes they are much flattened. The snail and whelk class have conical tubes coiled in a spiral, usually from left to right. Another class is shaped like a hollow cylinder, open at both ends, and looking much like an animal's tooth, whence they are called "tooth shells."

STONE BORERS

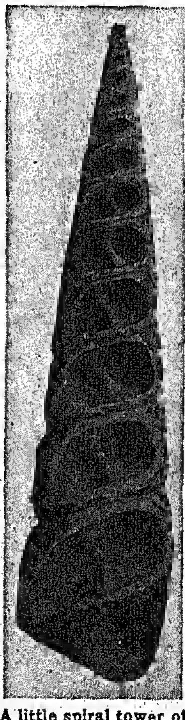
Bivalves have various accomplishments. Some can swim, some jump, some burrow. These Piddocks are borers in solid stone.

Everyone is acquainted with the beautifully conical shape of the conch shell, found on the Florida coast and the West Indies. The "queen conch" is the largest shell native to any part of the United States, sometimes measuring a foot long. These shells are used for parlor ornaments, and for dinner horns on Southern plantations. Loads of them are shipped yearly to Great Britain to be ground to pieces and used in the manufacture of porcelain.

Because of their beautiful coloring, many shells are manufactured into articles of adornment, such as brooches, bracelets, necklaces, and buttons (*see* Buttons); or they may be used for inlaying furniture, musical instruments, and other articles. Among those much in demand for such purposes is the abalone or "earshell," found in greatest perfection on the shores of California, where it sometimes grows ten inches long. This shell is a true spiral, but it is flat and therefore often mistaken for a bivalve. The inside is beautifully iridescent, and the exterior also takes a high polish. From these shells comes a large part of the mother-of-pearl of commerce, and great quantities are gathered annually for making pearl buttons. They cling to the rocks with terrible power and many a lonely fisherman has been drowned, it is said, by getting his fingers caught between the shell and the rock.

The beautiful "turban shells" from the Indian Ocean, the Philippines, and the Sea of Japan are also in great demand for making buttons and ornaments. They are large heavy shells, with rounded whorls shaped like a turban. The giant of the family is the "green turban" or "green snail," which the monarchs of Scandinavia used to mount in silver and use for drinking cups. The "Turk's cap" is a beautiful variety, from three to five inches across.

SCREW SHELL



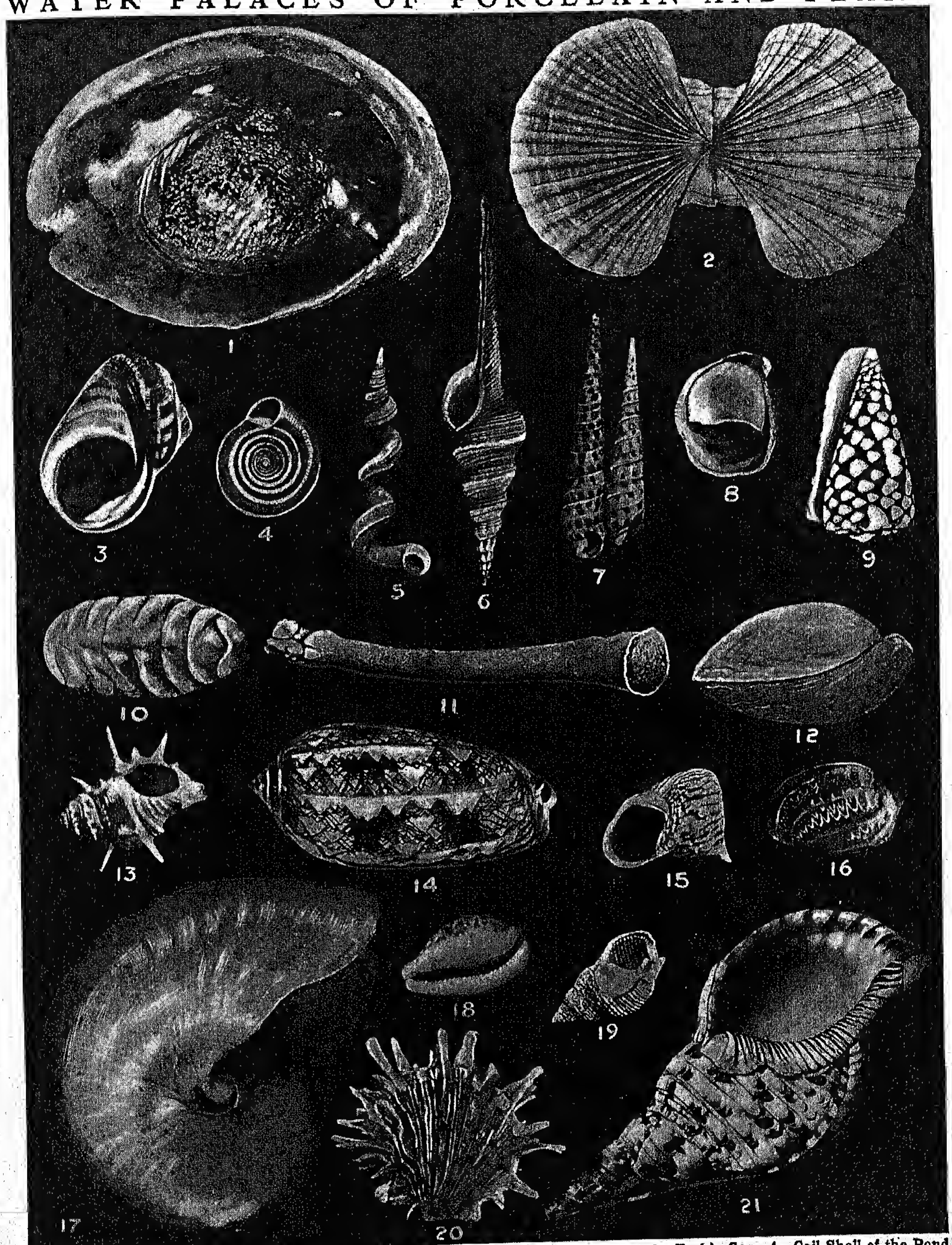
A little spiral tower of strong and beautiful design.

The "helmet shells" are notable for their use as cameos. They have a dark coat under a pale outer layer, so that figures carved on them stand out in bold relief against the black, red, pink, or orange background. The best for this purpose is the "black helmet," which is found on the Atlantic coast from North Carolina to the West Indies. Formerly all cameos were cut from stones, but many of the finest specimens of the last century have been cut from these shells (*see* Cameo).

Among many primitive peoples, as among the North American Indians, shells were used for money. The most widely used shells for this purpose are the beautiful cowries or "Venus shells," which exhibit an endless variety of color and shape. The "ringed cowry" is still the usual currency in a few of the more remote of the Indian and Pacific islands, and some tribes in the interior of Africa use strings of the "money cowry." Along the west coast of Africa this was the usual currency until past the middle of the 19th century, and traders made large fortunes by gathering these shells in the Indian or Pacific Oceans and exchanging them for ivory and other valuable goods in Africa. Where they are still used, their value ranges from 2,000 to 3,000 shells to the dollar. In one of the tribes of Africa the king's revenue was estimated at 30,000,000 shells a year, and from 20,000 to 60,000 cowries was the price of a wife.

The currency of the American Indians, known as "wampum," consisted of cylindrical fragments of quahaug, whelk, and periwinkle shells, rubbed smooth on stones and strung like beads on fine strands of skin. The white beads were generally rated at only half the value of the purple beads, made from the quahaug or hard clam. A six-foot string was worth from five to ten shillings. Wampum was the accepted medium of trade with the Indians until well into the 18th century, and a belt of wampum was given to bind every treaty. Necklaces and belts of wampum were also used as ornaments.

Shells, properly so called, are to be distinguished from the hard shield which covers such animals as the tortoise, the lobster, and the crab. This thick crust is called a "carapace," and is a thickening of the skin rendered solid by deposits of the same carbonate of lime of which mollusk shells are formed, and intermediate between shell and bone in general composition and character.



Here are shells from far and near: 1. Abalone or Ear Shell. 2. Crusader's Scallop. 3. Turk's Cap. 4. Coil Shell of the Pond Snail. 5. Worm Shell. 6. Distaff Spindle. 7. Two Auger Shells. 8. Arched Slipper Shell. 9. Marbled Cone Shell. 10. Showy Chiton. 11. Watering Pot Shell. 12. Fossil Lamp Shell. 13. Spiny Frog Shell. 14. Camp Olive Shell (see the tents!). 15. Tiger Top Shell. 16. Harp Shell. 17. Pearly Nautilus. 18. Tiger Cowry. 19. Channeled Basket Shell. 20. Painted Thorny Oyster. 21. Great Triton or Triton's Trumpet.

SHELLEY, PERCY BYSSHE (1792–1822). "A beautiful and ineffectual angel, beating in the void his luminous wings in vain"—so the great English critic Matthew Arnold characterized Shelley. The poet of clouds and sunsets and rainbows, of the swift wind, of the blue depth of the boundless sky, of the soaring skylark, Shelley seemed more at home in the heavens than on the earth. And still the great purpose of his life was not to soar among the clouds and write beautiful poetry. His ruling passion was to make the world better, to free mankind, "to purify life of its misery and evil." His work was ineffectual, for his schemes for reform were impractical and he knew little of real life; and in this lies the tragedy of his life. As a reformer he is almost forgotten; while as a poet he ranks among the highest in English literature. This is not the fame he desired.

A Dreamy and Romantic Figure

Even as a small lad Shelley was different from other boys. He was a beautiful youth, of slender figure, with complexion as fair as a girl's, and luminous large blue eyes, at times soft and dreamy, and at other times lit up with a wild and restless brilliance. Tales of romance and mystery fascinated him, and he delighted no less in the wonders of science, almost killing himself in chemical experiments. But his schoolmates could not understand why he took no interest in their games of cricket and football, and they called him "mad Shelley."

He imbibed the spirit of the French Revolution, which was still in the air, and rebelled against the tyranny that he saw everywhere, in government, in society, and in religion. He was expelled from Oxford University for writing an attack on religion, and his father, a baronet of an old Sussex family, understanding him as little as did the rest of the world, cast him off. Though without means, Shelley married a girl of 16, out of pity, because he felt that she, too, was oppressed and misunderstood. Shortly afterward he went to Ireland and tried to arouse the Irish to a sense of their wrongs, but without success.

His Tragic Death in the Sea

In 1818 he left England for Italy, where he spent the remainder of his life. In the meantime his first unhappy marriage had ended tragically, and he had married again, this time finding sympathy and understanding. During these years he wrote his beautiful poetic drama, 'Prometheus Unbound', and those matchless lyrics, 'The Cloud', 'To a Skylark', and 'Ode to the West Wind'. Here, too, he wrote his wonderful elegy, 'Adonais' on the death of his brother-poet John Keats, little knowing how soon his own life was to be cut short. He was drowned while sailing with a friend off the coast of Leghorn. His body was recovered and cremated on the shore. The poet died just a little more than a year after he had written these sadly prophetic lines:

> The breath whose might I have invoked in song
> Descends on me; my spirit's bark is driven,
> Far from the shore, far from the trembling throng
> Whose sails were never to the tempest given;
> The massy earth and sphered skies are riven!
> I am borne darkly, fearfully, afar;
> Whilst burning through the inmost veil of Heaven,
> The soul of Adonais, like a star,
> Beckons from the abode where the Eternal are.

In addition to those mentioned, Shelley's chief long poems are: 'Queen Mab' (1813); 'Alastor, or The Spirit of Solitude' (1816); 'The Revolt of Islam' (1817); 'The Cenci', a tragedy (1819); and 'Epipsychidion' (1821). Among the shorter poems are: 'Hymn to Intellectual Beauty' (1816); 'Mont Blanc' (1816); 'Ozymandias' (1817); 'Lines Written among the Euganean Hills' (1818); 'The Indian Serenade' (1819); 'The Sensitive Plant'; 'Arethusa' (1820); 'To Night' (1821).

The PROBLEM *of* SHELTER *and how* MEN HAVE SOLVED IT

From the Cave Dwelling to the Apartment House—Habitations in All Lands and All Ages Tell the Story of Man's Progress in Civilization—The World's Materials Made Available by Modern Commerce

SHELTER. Everywhere men are busy with hammer and saw, trowel and chisel, steam crane and steel riveter, as well as with old and crude tools, constructing dwellings to protect themselves and their families from sun, wind, cold, and enemies. Building homes seems to be a never-ending task.

Our word *shelter* comes to us from an early English term, a *shield-troop,* and so the idea of defense is an important part of its meaning. Ages ago, primitive man found shelter from prowling foes in tree tops, and natives of New Guinea today still build nestlike thatched huts in trees, using ladders that may be lifted when enemies approach (*see* New Guinea). The cliff dwellings of Indians in the North American Southwest, the castles of medieval Europe, and the blockhouses of the American pioneers were built chiefly for defense. (*See* Castle; Cliff Dwellers.)

Perhaps the cold that spread with the coming of the Ice Age first sent people scurrying to caves for shelter. With flaming firebrands they drove out wild beasts; and then kept fires blazing at the entrances, and heaped stone barricades just outside. (*See* Cave Dwellers.)

One family after another occupied these caves. They made no permanent homes, for they had to follow their game animals. When their wandering life took them where no caves offered a night's lodging, they were forced to throw up crude shelters of tree branches or bark. Gradually they learned to make more substantial huts by using for a framework a circle of saplings drawn together at the top, and even weaving an outer covering of grass, reeds, or leaves.

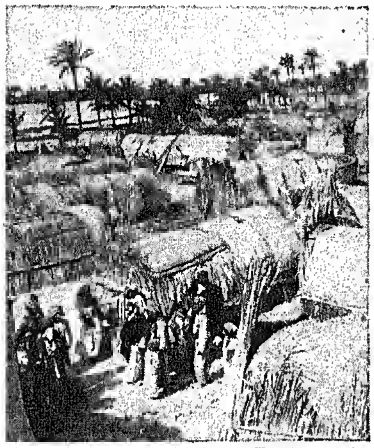
Modern primitives still live in huts made from whatever trees, shrubs, or grasses grow around them.

In bleak Tierra del Fuego, the hardy, skin-clad hunters throw together rough brush shelters or merely crawl into a thicket on the hunt. Australian "blackfellows" pile up crude dome-shaped huts of bark and branches with a grass covering that look like tumble-down straw stacks. For winter, most Eskimos build rude igloos, partly underground, walled with rocks and earth, and line the interior with warm furs; a few tribes occasionally use temporary igloos built from blocks of snow and ice. The summer homes of some Eskimos are little more than tents of sticks and skins. (*See* Eskimos.)

Some tropical races have grown exceedingly skilful at weaving basketwork dome-huts from reeds, slender tree limbs, and grasses. Samoan houses thatched with palm leaves and the "mushroom" shacks of the Kafirs in South Africa are airy yet waterproof.

PRIMITIVE DWELLINGS USED IN MODERN TIMES

Lake dwellings built on wooden piles have been used by primitive peoples since the Stone Age. These huts at Lake Maracaibo in Venezuela were in use until the development of the oil industry in the region. Note the movable bridge to be drawn up in event of attack.



These huts along the lower Euphrates in Mesopotamia are typical of native tropical shelters. They are made of reeds and mats, without windows and with rounded roofs, to keep out heat or let it rise to the ceiling.

Some Characteristic Dwellings of the Nomads

Early men followed their flocks and herds in search of green pastures, and learned to drape skins over a frame of branches for their tents, which they could carry with them. Hebrew herdsmen of Bible times drove three rows of stakes into the ground, the middle row higher than the front and back supports so that the rain would slide off the skin covering. They soon learned to weave tent cloth from dark goat hair. Nomadic Arabs who pasture their camels on the sparse desert plants make their tents almost the same way today (*see* Arabia and the Arabs). The migratory Indians of the American plains had a cone-shaped teepee of skins, with a hole at the top for the camp fire's smoke.

Settled dwellings came only when folk started to live by farming and stayed with their crops from seed time to harvest. Some of the farmers of the Stone Age and the early metal ages built huts on piles driven into lakes, in Switzerland, Italy, and elsewhere. The thousands of piles, evidence of a village of several hundred persons, show how folk had advanced in community organization after they had a surer food supply (*see* Food). Logs crossed at the ends tell of the beginning of log cabin building, and there are other indications of early frame construction. The bridges, which reached to the shore line and were lifted to keep out intruders after sheep and cattle had been brought to shelter for the night, lie buried beside the dugout canoes that carried the farmers to their flax and grain patches on land. Their flat stone hearths, their cooking pottery, their many weapons, tools, and implements have been brought to light by archeologists. Shacks built over water for protection and sanitation stand today in Venezuela, Brazil, the Sulu Islands, and Siam.

In other places agricultural peoples built dwellings much like the "longhouse" of the Iroquois Indians in North America. Lashings of skin, tendons, or strong fibers not only bound the rows of saplings, which were bent to form an arched roof, but also fastened the bark covering to this frame, for iron nails were still unknown. The smoke from the row of cooking fires—each for a separate family—curled through the space where the saplings met or billowed out the small door, leaving a coat of soot all over the dark low interior. (*See* Indians, American.)

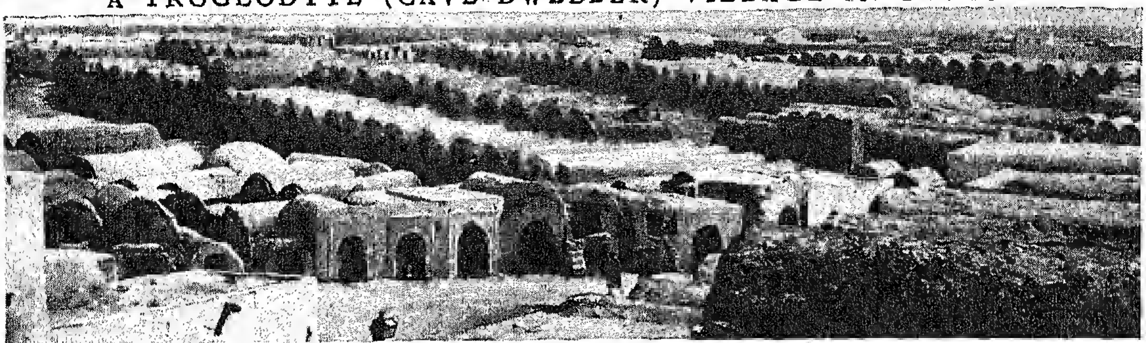
How the Early Civilizations Were Housed

Civilization's first houses stood in Mesopotamia and Egypt. Their sun-baked clay-brick walls have long since crumbled into mud heaps. Archeologists have uncovered foundations and fragments of wall which show that these blocklike, flat-roofed dwellings differed little from the homes of present-day farmers along the Nile. As Egypt grew in wealth and culture, nobles set their houses around an open court. (*See* Archeology.)

The sun-loving Greeks centered their flat-roofed symmetrical houses around an open courtyard. These dwellings were as simple as bungalows. As Greek influence spread across the oriental world, houses of the well-to-do were larger, and stone work sometimes replaced the sun-dried bricks in the walls.

A simple dwelling with a central room called the *atrium*, which contained the hearth and had a smoke-hole in the roof, sheltered the leaders who started Rome toward world conquest. The Greek colonnaded court and the rich refinements of other subject lands were added as wealth and dominions grew. We can see the grandeur of these houses in the ruins of

A TROGLODYTE (CAVE DWELLER) VILLAGE IN TUNISIA



Since primitive times man has used the materials nearest at hand to build a shelter best suited to his comfort. These two-story houses of African troglodytes are made of adobe (sun-dried clay), with crude steps or ladders leading to the upper story. Again we find rounded roofs and no windows, like the huts of so many tropical dwellers, to keep out heat and to let warm air collect at the top of the room where it acts as an insulating layer or blanket.

Pompeii sealed in volcanic lava by Vesuvius many centuries ago (*see* Pompeii). Crowded Rome built tenements and apartment houses of several stories, surprisingly like those of our own large cities.

Early Dwellings in Northern Europe

While the Mediterranean world enjoyed such "modern conveniences" as running water, baths, sanitary equipment, and piped hot-water or hot-air heat, our ancestors in the forests of northern Europe were still a barbarous people, just beginning to develop a shelter suited to their sterner climate. Low walls of wood, or a wooden framework filled with clay, held a high, steeply sloping roof, designed to shed the winter's heavy fall of snow. Birch bark covered the roof rafters, and a heavy coat of sods lay on top. Grass and weeds grew there, and grazing goats and sheep, clambering over it, made the dwelling look more than ever like a hummock in the soil. Its tiny doorway faced westward to avoid the coldest winds. It raised its threshold high and dropped its lintel so low that guests had to stoop to enter. In the roof, the open "wind's eye" (window) drew the smoke from the roaring fire that marked the center of the hall. The high seats of the master and mistress and the honored guests, which flanked the blaze, were raised above the rest of the long seat that extended around the walls. In the straw or rushes that covered the barren floor of hard beaten earth, chickens scratched when storms drove them and the young pigs, calves, and lambs into the only shelter on the whole estate.

Here lived a motley group, not only the parents and children, but also the many servants and the *hird*, or band of retainers, who fought for the chief. In this one great room all slept and ate and performed their daily tasks.

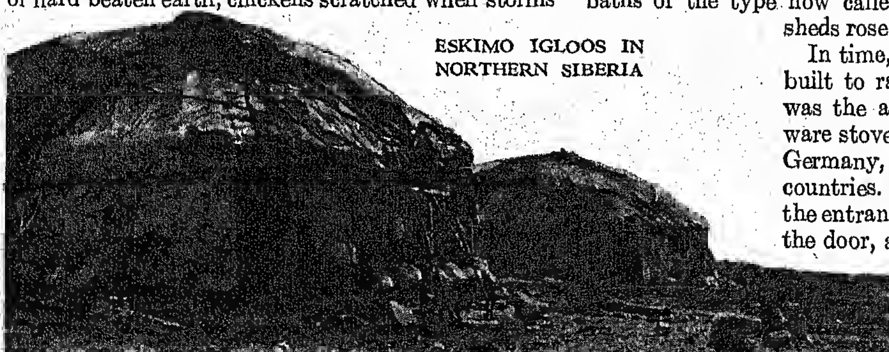
How People Lived in the Age of Feudalism

From great halls of this type there developed the strongly fortified castles necessary in the Feudal Age, and also the house as we know it today, a product of more peaceful times. Space under the eaves was partitioned off for sleeping-rooms and subdivided into lock beds—cubby-holes just the size of the bunks, with doors that shut tight and fastened with a stout wooden bolt at night. Sometimes the west end of the hall was separated from the rest by a partition and divided into an entry, a belfry where sentinels could guard the entrance, a storeroom, and a strong sleeping-place called the "ramloft."

Later other buildings were added. The "bower" was placed on high wooden posts to keep vermin from the rich clothing, embroidered hangings, and other treasures stored there. Sometimes it became the sleeping-room for master and mistress or for honored guests. Cooking went on in the "seething-house." If hot springs flowed near by, their water was piped to baths of the type now called Turkish. Barns and sheds rose to shelter the live stock.

In time, a masonry furnace was built to radiate heat all day. It was the ancestor of the earthenware stove still popular in Russia, Germany, and the Scandinavian countries. The furnace stood near the entrance to get a draft through the door, and the seat of the master was often moved near to its warmth. As a result the place of honor was shifted from the center to "the head of the table."

ESKIMO IGLOOS IN NORTHERN SIBERIA



In barren Siberia, Eskimos build round huts of stones and driftwood cast up by the sea. Coverings of dried walrus skins, anchored with heavy stones to keep the sharp winds from tearing them away, serve to keep out the bitter cold. Windows are omitted, to conserve what little heat the shelter affords.

Invention of the chimney in the 12th century transformed the spacious hall. The space near the ceiling became the second story, which was sometimes reached by an outside staircase. Then the builders lifted the side walls higher and cut windows in them. At first, these were just openings that could be closed by a shutter in stormy weather, for glass was too costly for general use. Even in the 16th century, English nobles had the glass windows of their country places packed away while they visited in London. Partition into rooms followed, and small movable furniture was introduced.

Houses Built over Streets

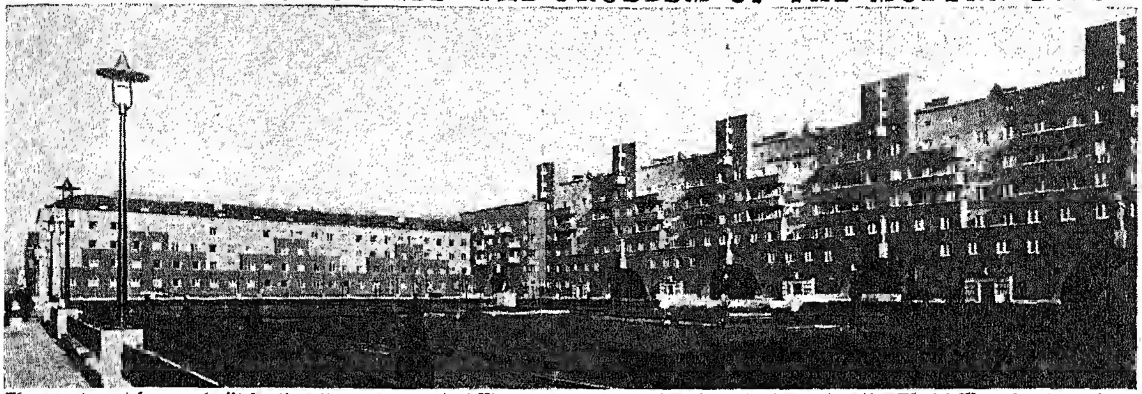
As cities grew in wealth and power during the Middle Ages (*see* Middle Ages), their dwellings improved even more than those in the country. They need not provide the fortifications of the castle, for the city's ring wall met invaders. The additional space of the extra story was needed in these crowded towns. Some householders began to extend the second story out over the street. This plan, still in use in European countries, darkened and stopped air circulation in the dirty streets. An open gallery was often built along the upper story under the shelter of the projecting roof. House materials also changed. The wooden frame still survived, but the fire-trap thatched roofs were being outlawed, and shingles, slate, or tile replaced them.

The residence contained the master's workroom and shop as well as his living quarters. Besides the living-room, the kitchen, and the bedrooms, medieval townspeople had many chambers unknown in our houses today—the "great room" where the family's tapestries and other treasures reflected their wealth and taste, and where weddings, christenings, and other gala affairs were celebrated; the storerooms for immense supplies of provisions; an entire room where soiled linens waited for the semi-annual washday; the milk and cheese pantry; and the Turkish bath.

In the following centuries, science and industry wrought many changes. The home trades moved, first to the workshop, then to the factory. Many of the tasks of the housewife and her servants were taken over by industry. Pure running water, sanitation and sewer systems, clean paved streets, central heating, illuminating gas, and electricity added to health and comfort.

The house and its furnishings gained in beauty and artistry also. The glorious architecture of the Renaissance came to be applied to homes as well as to public edifices. Clever architects found the dwelling worthy of their best efforts. Artistic cabinetmakers created furniture in the 18th century that is admired today. Some of the finest features of European house and furniture design were imported into America. (*See* American Colonies; Interior Decoration.)

LIGHT AND AIR FOR ALL—THE PROBLEM OF THE MODERN CITY



The apartment houses built by the city government of Vienna to relieve its housing shortage after the World War of 1914–18 have served as models for the rest of the world. The enormous building above shows how well the Viennese architects solved the problem of providing sunlight and air, with ample recreation space, for units housing hundreds of families.

Houses in the Western Hemisphere

In America, pioneer folk first raised log cabins. They often huddled within a log stockade that helped defend them against the Indians. Frame later became the cheap and popular construction in this wooded land. Out on the northwestern prairies, where trees are few, settlers erected sod huts for their first shelter.

In the warm, dry Southwest, and in arid spots of South and Central America, Spanish colonists erected adobe houses, with the inner court, the flat roof, and the blank outer wall favored in Latin countries. Adobe resembles the sun-dried brick of ancient times. The Pueblo Indians had used the adobe clay for mortar in their cliff dwellings and pueblos of pre-Spanish days. Now they adopted the clay bricks for their well-defended pueblos. (*See* Pueblo Indians.) Ingenious in plan and construction as were these many-storied shelters, the Maya, Aztec, and Inca in South and Central America far surpassed them by building splendid masonry structures that have defied time and earthquakes.

Where Paper is Used for Houses

The one-story adobe house is the chief shelter in these quake-racked lands. Japan, with the same problem of frequent tremors, builds light, low, frame cottages, divided by fragile paper partitions (*see*

Japanese Art and Architecture). In both Japan and China the roofs are wide and projecting, with curving, turned-up corners. The fine country homes of China show the inner-court plan of the Roman villa. Restricted neighborhoods for rich residences are unknown in old Chinese cities. The squalid hut of the coolie—often a mere shed of rice-straw mats—clings to the walls of a palace.

Housing Standards in the United States

The United States has contributed no new style in domestic architecture, but has modified the fashions of older nations to its own purposes. The nation's chief gift to shelter planning is convenience of interior arrangement and creation of labor-saving equipment. Modern houses are miracles of simplicity and efficiency as compared with the hall or the manor of an earlier day, with a consequent decrease in the need for household servants and lightening of the housewife's task. The new land's wealth and its democratic ideals have combined to give American workers a better housing standard than that of other countries. In great cities, apartments have replaced the one- or two-family house of town and suburb. The enormous rise in urban land values and the perfection of steel construction have lifted apartment buildings to towering heights. Space per family has been cut with the development of the "efficiency" apartment, with its tiny kitchenette, wall bed, and other space-saving features. (*See* Building Construction; City.)

Shelter Problems of the Modern World

The shelter problem has changed vastly since the time when men had to seek whatever materials they could find at hand and build them into the best shelter they could fashion. Commerce has made the building materials of the whole earth available; man's ingenuity has fabricated new materials; and expert trades have taken over the work of construction. The question of rent and of the respective responsibilities of landlord and tenant, the real estate business, building and loan associations, coöperative building societies—all these and numerous other problems and agencies are an outgrowth of man's need for shelter and the means he has adopted to obtain it.

We hear much today of "the housing problem." So vital have questions of housing and town planning become that world meetings are held periodically to discuss them. When people began to flock to industrial centers in great numbers, many had to live crowded together in dilapidated and insanitary dwellings, and great slum areas developed in cities. Housing and zoning laws were passed, but there was little progress in providing decent housing for the low-income groups at rentals which they could afford to pay. In Europe the housing problem grew acute during the World War, when there was almost no building. After the war the governments in many countries provided relief by building with public funds various types of dwellings, from single-family homes to huge apartments capable of housing as many people as a good-sized village; or by granting subsidies and lending funds at low interest rates to housing enterprises.

In the United States, progress was slower, and there were only a few model housing projects carried on by philanthropists and private interests. But when the housing problem became especially acute during the depression of the early 1930's, the Federal government embarked on a program to promote low-cost housing and slum clearance and at the same time to relieve unemployment in the building trades and allied industries. (*See also* Reference-Outline for Sociology.)

SHERIDAN, GENERAL PHILIP HENRY (1831–1888). "Fighting Phil Sheridan" ranks with Grant and Sherman as one of the three great generals on the Union side during the War of the Rebellion, and he was the only one of the three who devoted his whole life to the profession of arms. Born in New York of Irish parents, Sheridan had secured as good an education as was afforded by the schools of the frontier state of Ohio, to which his parents had removed soon after his birth. Sheridan was ambitious and determined to succeed in life, and the outbreak of the Mexican War fired his ambition to be a soldier. He accordingly secured an appointment to West Point from which he was graduated in 1853. His first actual experience in warfare was gained on the western frontier in campaigns against the Indians in Texas and Oregon.

At the outbreak of the Civil War he was a first lieutenant, but, because of the distinguished service which he rendered, his promotion was rapid, until he reached the rank of major-general of volunteers. His first services were in the West, where he distinguished himself in the battles of Perryville, Stone River, Chickamauga, and Chattanooga. At the battle of Missionary Ridge, Sheridan led the men who charged up the hill, and he was one of the first to reach the crest.

When Grant, who had witnessed Sheridan's exploit at Missionary Ridge, was placed in command of the United States Army, he gave Sheridan command of the cavalry of the Army of the Potomac. During the Wilderness campaign of 1864, Sheridan aided Grant by harassing the enemy and cutting their lines of communication.

In July of that year, when a strong Confederate force under Early had defeated the Federal army in the Shenandoah valley, penetrating into Maryland and threatening Washington, Grant saw the necessity of putting the department in the hands of an able general. In August he placed Sheridan in command in the Shenandoah, with instructions to drive the Confederates out of the valley. So well did Sheridan succeed in carrying out these instructions that he put an end to the war in northern Virginia. He attacked Early at Winchester and again at Fisher's Hill, defeating him at both points, capturing 5,000 men and many guns, and pursuing him to Staunton. In recognition of this service Sheridan was made a brigadier-general in the regular army. Early's army, receiving large reinforcements from Lee, again

advanced into the valley, surprised the Federal army at Cedar Creek in the early morning of October 19, and drove them back in confusion. Sheridan was absent from the army, having been to headquarters in Washington. He reached Winchester, 20 miles from Cedar Creek, on his return when he heard—

> The terrible grumble and rumble and roar,
> Telling the battle was on once more.

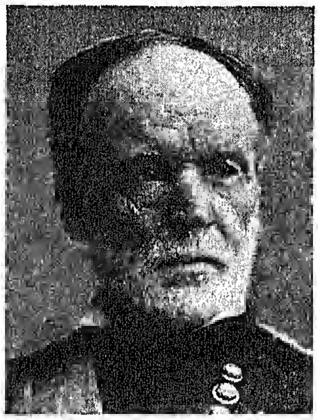
Hurrying forward, he reached the field. Speedily forming a line to stop the stragglers, he rode forward waving his hat and shouting, "Face the other way, boys; we are going back." Confidence was restored, the lines re-formed, and at 3 p.m. they moved back upon the enemy. The result was the total rout of Early's army, which was pursued up the valley for 30 miles. For this victory Sheridan was promoted to be major-general in the regular army, and received the thanks of Congress. The spirited statue in Washington by Borglum represents him at the moment when he is rallying his men on the Winchester road.

After devastating the Shenandoah valley, the granary of the Confederacy, so that it was said that a crow flying over it would have to carry its rations with it, Sheridan returned to the Army of the Potomac in March 1865. He was conspicuous under Grant in the operations before Petersburg and in the final battles preceding Lee's surrender. He compelled the evacuation of Petersburg by his superior generalship at Five Forks, where he entrapped and routed the Confederate troops under Pickett, capturing more than 5,000 prisoners.

After the close of the war Sheridan was placed in command in the Southwest near the Mexican border, where his benevolent attitude helped the Mexican patriots in their struggle against Emperor Maximilian, and later, of the department of Missouri, with headquarters at Chicago. When Sherman was made general, Sheridan was made lieutenant-general. He was the American military observer with the Prussian army in the Franco-Prussian War in 1870. In 1883 he became commander-in-chief of the army, and the rank of general was conferred on him a few months before his death. He was the last to hold this rank until it was conferred on Pershing.

As a field commander Sheridan was unapproachable. Filled with the ardor of battle, so that it was said he raged like a lion, his skill equaled his courage. He never lost a battle; and stood, after Grant and Sherman, one of the greatest Northern generals. Grant said: "As a soldier there is no man living greater than Sheridan. He belongs to the very first rank of captains, not only of our army, but of the world. I rank him with Napoleon, Frederick, and the great commanders of history."

SHERMAN, GENERAL WILLIAM TECUMSEH (1820–1891). Scarcely second to General Grant in bringing to a successful close the military operations of the Civil War was William Tecumseh Sherman, a brother of the statesman, John Sherman. Like Grant he was born in the then frontier state of Ohio a few years after that region had been freed from the menace of the Indian chief Tecumseh, and was named in memory of that noble warrior. Although the boy was left fatherless at an early age, he enjoyed greater educational advantages than did most boys of his time, due to the kindness of his father's friend, Thomas Ewing. After he had finished the academy in his home town of Lancaster, Ohio, he secured an appointment to the military academy at West Point, and was graduated from there in 1840 near the head of his class. He was immediately given an appointment in the United States army, and during the Mexican War saw active service in California. By the end of that war he was tired of military life, and resigned his commission to enter on a business, legal, and educational career. At the opening of the War of Secession we find him at the head of the state military academy of Louisiana. But his sympathies and duty lay with the North, so resigning his position, he hurried to Washington to offer his services to his country. The offer was accepted, he was commissioned a colonel, and commanded a brigade in the first battle of the war at Bull Run.



GENERAL SHERMAN

When the plans for the conduct of the war were matured, in August 1861, it was decided to send Sherman—now a brigadier-general—to the West, where he was placed in command of the Department of the Ohio. Immediately on taking charge of the department he reported to Washington that 200,000 men would be needed to carry on the campaign in the Mississippi valley. The North at that time had no adequate idea of the immensity of its task, and the papers said that Sherman was "crazy." Time proved that his estimate was correct, but he was sacrificed for the moment to the popular clamor against him and removed from his command.

Sherman's military genius was so great that he could not long be kept in the background. At the battle of Shiloh, April 6, 1862, he was in the thick of the fight. He had three horses shot from under him and was twice wounded, but he helped save the day for the Union army. For his services he was given the rank of major-general. Serious mistakes had been made at the battle of Shiloh, and the commander, Grant, had to endure much criticism. Grant wished to withdraw from the army entirely, but Sherman persuaded him to stay, reminding him of the storm of criticism he himself had weathered.

Sherman did more than talk. He backed up his words with deeds, and in the Vicksburg campaign rendered valuable aid to Grant. At its successful conclusion he generously gave all the credit to his superior officer. When Grant, as a result of this campaign, was made commander of the armies of the United States, Sherman was appointed to fill Grant's position as commander in the West.

His Most Famous Campaign

It was in this position that he carried on the campaign on which his fame chiefly rests. On May 6, 1864, he left Chattanooga, Tenn., for Atlanta, Ga. It took him four months to cover the 135 miles between the two places, for in this campaign he met a foeman worthy of his steel in Gen. Joseph E. Johnston, the Confederate commander. Difficulties were about evenly balanced, but Sherman possessed the love and confidence of his men to a much greater degree than did his opponent. They knew that when they saw "Uncle Billy and his white socks" all was well.

Atlanta was reached on September 2. After clearing the city of its civil population and resting his men, Sherman started on his famous march of 400 miles "from Atlanta to the sea." For 32 days no news of him reached the North. He had cut himself off from his base of supplies, and his men lived on the country through which they passed. They covered a path 60 miles wide in their march, and in that path everything which they could not use but which might prove of use to the enemy was ruthlessly destroyed. When we consider this destruction is it any wonder that Sherman said that "war is hell"? Finally on December 20, Savannah, Ga., was reached and Sherman telegraphed to President Lincoln: "I beg to present you as a Christmas gift the city of Savannah, with 150 heavy guns and plenty of ammunition, and also about 25,000 bales of cotton."

The Surrender of Johnston

After a month's rest Sherman turned North with his army, expecting to join Grant near Richmond, the Confederate capital. But before he reached that place the Confederacy had collapsed. After receiving the surrender of General Johnston in North Carolina, Sherman marched on to Washington. He thus completed a march of nearly 2,000 miles through the enemy's country, one of history's greatest campaigns.

Having achieved such fame in the army, Sherman decided not to return to civil life. He remained as commander in the West until Grant was elected president. He was then made commander of the United States Army and given the rank of general, a rank which previously had been held only by Grant. He held the command of the Army until 1884, when he resigned, after 23 years of continuous army service.

SHETLAND ISLANDS. In that far-away time when the Shetlands were inhabited by a short dark people called the Picts, the Romans named the islands *Ultima Thule*, "the farthest land," or end of the world. But to the Vikings of Norway and Sweden these islands were near neighbors, easily visited in their long boats. Everywhere we see reminders of those days—burial mounds, stone circles for Druid rites, crumbling stone watch towers.

These islands are a region of fogs, storms, and long winters, where little except potatoes, oats, and barley can be grown. The islanders live principally by fishing, but they also raise Shetland ponies, a small breed of cattle, and sheep. They make excellent knitted goods and tweeds from native wool. Hard as their life is, it yet has the compensation of ruggedly beautiful surroundings. The ocean is everywhere, dashing against brilliantly colored cliffs, and so penetrating the land by firths that no point is more than 3 miles from the sea. A striking natural feature is the Grind of the Navir, or Gate of the Giants, carved by waves from the porphyry cliffs.

The Shetland group contains more than 100 islands and islets, with a land area of 550 square miles. The largest is Mainland, with about two-thirds of the total area. On Mainland is the capital, Lerwick. The group lies 120 miles northeast of the Scottish mainland, and about 200 miles west of Norway. It was ceded by Norway to Scotland in 1468 and forms a Scottish county. Population, about 20,000.

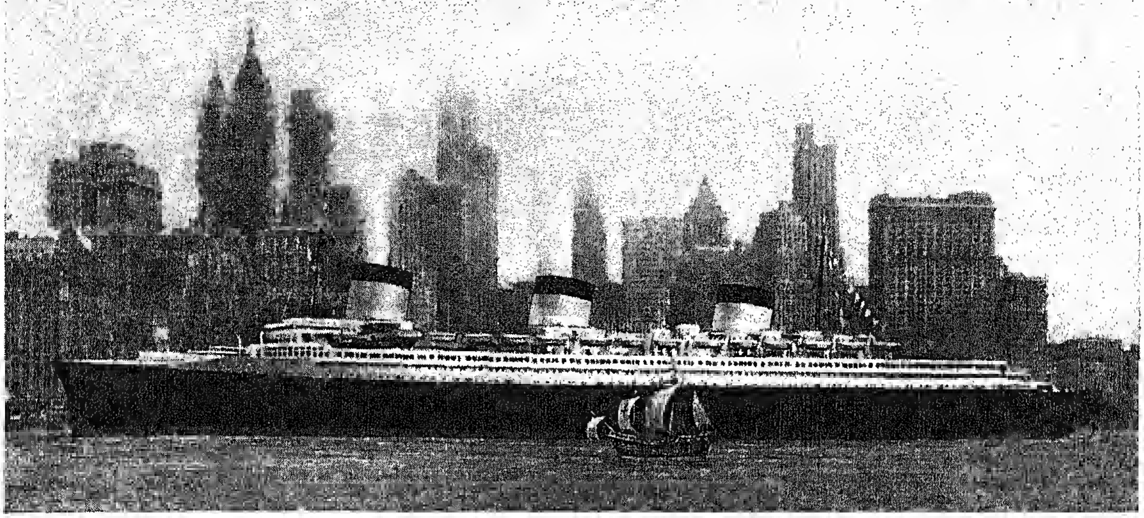
SHILOH (*shī'lō*), **BATTLE OF.** On Sunday morning, April 6, 1862, General Grant sat enjoying a leisurely breakfast below Pittsburg Landing on the Tennessee River, while his army cooked breakfast in the camps grouped about Shiloh church not far away. Nobody expected trouble from the retreating Confederate forces under Gen. A. S. Johnston supposed to be camped at Corinth, 20 miles away; Grant had not kept cavalry out watching the Confederates, nor had he posted outposts sufficiently far in front.

Suddenly the crack of rifles and roar of battle broke the calm. When Grant reached his troops, his situation looked disastrous. The Confederates in full force had burst from covering woods and were driving desperately resisting bands of Union soldiers from their camps. All day the battle raged, with terrific losses; practically no control could be exercised by either commander over his raw troops. By night, the Union troops had been driven almost to the river.

The situation changed over night. General Buell arrived with 25,000 Union troops, and General Johnston of the Confederates died of a wound he had suffered while leading a charge. His successor, General Beauregard, was driven from the field next day and retired to Corinth. The Union armies of some 70,000 lost about 13,000 killed and wounded. The Confederate loss was 10,000 out of some 40,000.

Shiloh was the second great battle of the Civil War and the most bitterly fought engagement of the whole struggle. Bitter criticism was heaped upon Grant for his heavy losses. But President Lincoln refused to remove him, and Grant soon justified the president's faith in him. The Confederates, on the other hand, had lost almost as heavily and had missed their chance to break up the Union advance in the West.

OAR, SAIL, *and* STEAM—*The* STORY *of* SHIPS



How Columbus' *Santa Maria* Compares with the Modern *Normandie*

FOR thousands of years men have been building ships, so that they could turn the "estranging sea" from a barrier to travel into an aid. Beginning with lotus-tailed Egyptian galleys and gay-sailed Phoenician craft—

Their hulls were heightened, their sails spread out,
they grew with the growth of their quest;
They opened the secret doors of the East,
and the golden gates of the West,
And many a city of high renown
was proud of a ship on its crest.

Today steel passenger leviathans and cargo carriers multiply wealth, build national power, and place the resources of the world at the disposal of everyone everywhere. Here is the story of ships and what they have done.

SHIPS. Picture Columbus' flagship, the *Santa Maria*, lying beside a giant modern liner. The *Santa Maria* will be about the size of a small house; the liner will be a block or two long. The liner offers the luxuries of a great hotel, and it may carry 3,000 people or more—sixty times the number that were packed in Columbus' little ship. This picture shows you how the art of shipbuilding has developed in the four and a half centuries that have passed since the time of Columbus.

This dramatic contrast, however, shows only the final spurt in a record of shipbuilding that extends back before the dawn of history. Probably the story of ships began when our prehistoric ancestors learned that tree trunks and branches would hold them up in water. Others living in treeless lands learned to use bundles of rushes tied to form a rough boat. Still others used baskets or rafts floated on inflated skins. In many backward parts of the world the people still use such craft (*see* Boats and Boating). The discovery of how to build and sail sea-going craft seems to have been made some time before the Pyramid Age (3000–2500 B.C.) in Egypt, at about the same time among the Sumerians on the Persian Gulf, and perhaps also in Crete and in China.

Beginnings of Shipbuilding

Above all else, a ship must be able to float and support a load. "Floating power," or buoyancy, depends largely on the relative size of the hollow space inside the hull; and a round shape gives the largest hollow space for a given size of hull. Hence, ships built for carrying have always tended to be tubby. The "round ships" of ancient times, with crude sails, were so clumsy that they could make only a mile or two an hour.

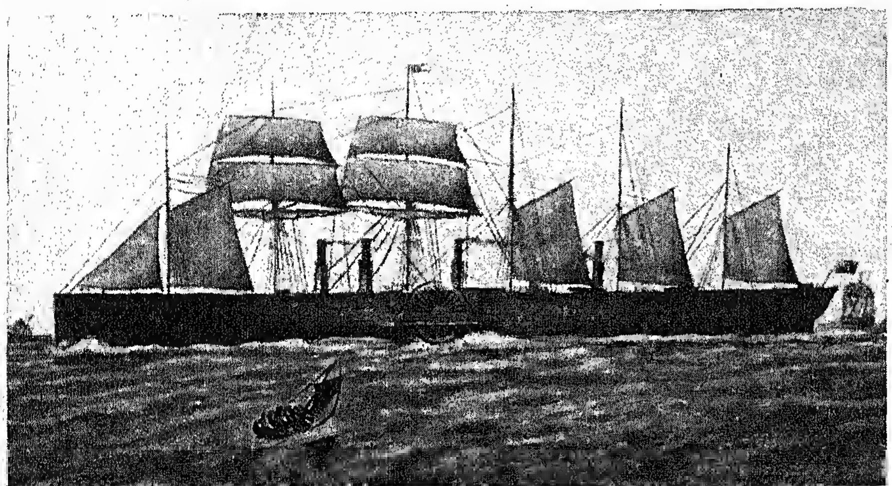
But a ship should also steer well and ride well over waves; and, at least for war, it should be speedy. The best kind of ship for these purposes is a long, somewhat narrow ship. Such a ship also needs a keel, or "fin," below, so that in a rough sea it will not roll over like a log. The ancients used sails on these longships, but they relied principally upon oars, because oars gave greater speed and made maneuvering easier. Oddly enough, the Greek word from which we seem to have got our word "galley" was applied to the round ship and originally meant "water bucket" or any round vessel. Later the term was transferred to the longship. The contrast between round and long ships can still be seen by comparing a modern destroyer or liner with the usual broad-beamed cargo vessel.

Real shipbuilding became possible when men learned to saw trees into timbers and planks and fit these materials together into a vessel larger than they could hollow out from a tree trunk. Such ships are pictured in Egyptian paintings of the 28th century B.C. The Cretans (*see* Aegean Civilization) also built ships for sailing the Mediterranean. But the greatest sailors of ancient times, after about 1200 B.C., were

the Phoenicians. Their war galleys carried sharp beaks for ramming enemy craft, and had two or more banks of oars for greater power and speed. From this model the Greeks and Romans developed their "biremes," with two banks of oars, "triremes," with three banks, and great round ships for cargo work. Such ships were used in the Mediterranean until the Crusades.

During the early Middle Ages the Scandinavians made a great advance in seafaring. They undertook bold voyages on the Atlantic in their long, beautifully shaped "serpents" and "dragons," with one great sail and one bank of oars (*see* Northmen). This type of vessel was combined with Mediterranean types during the Crusades, and improvements were invented. Instead of a steering oar hanging over the right side (whence *starboard*, from "steerboard," the right side), the steering blade, now called a *rudder*, was hinged at the stern, where it would not pull out of water when the ship rolled. It was turned with a tiller, or bar handle, until the steering wheel was invented in the 18th century. Sails were improved until oars could be dispensed with, except on the large Mediterranean war galleys and trading ships used on long voyages. "Castles," originally erected fore and aft as posts for archers, became the permanent "forecastle" and "after castle" of the ship. These castles were used for living quarters, and also kept great waves from sweeping the decks.

AN EARLY LEVIATHAN, THE 'GREAT EASTERN'



The *Great Eastern* (originally called the *Leviathan*), a paddle and screw steamship launched in 1858, was for many years the largest ship in the world. It was nearly 700 feet long, 83 feet broad, and 60 feet deep. It was far in advance of its time, and was never a financial success.

The Great Voyages of Discovery

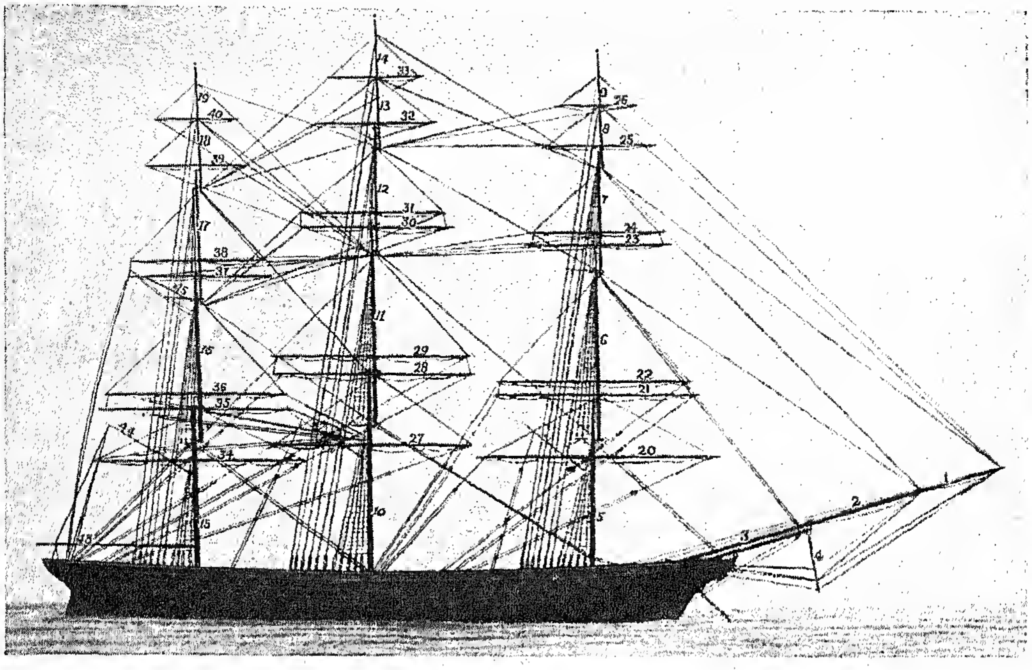
These improvements came in the same period when Mediterranean navigators learned to use the magnetic compass (*see* Compass, Magnetic; Navigation). Men now were equipped to sail the high seas; so the mariners of Genoa and Portugal, and later of Spain, sought sea routes to the Orient (*see* America). In the north, the Hansa towns were active; later England and Holland took to the sea.

As England grew to be the "mistress of the seas," sails, used more skilfully by English seamen than by their predecessors, became the only motive power for merchant and naval vessels alike. Craft that would be recognized by a modern sailor began to appear on the seas—full-rigged ships in the modern technical sense, brigs, barks, etc. High-water mark in the development of the sailing vessel for beauty and speed was attained, however, not by British vessels, but by the famous "Yankee clippers" of the 1840's and '50's. Previously the hulls of merchant ships had been constructed for capacity rather than speed. The loss and ruin sometimes incurred in the East India and China trade through market changes or deterioration of cargoes on long voyages stimulated the construction of a new type—a long slender vessel, at first small, but later from 135 to over 300 feet long—with fine lines, sharp bows, towering masts, and an immense spread of square-rigged sails, which slid or "clipped" instead of pounding through the water by main force. This was a distinct type from the long, low, rakish, and comparatively small craft —60 to 125 feet long—with full round bows and sails, sometimes square and sometimes schooner-rigged, which had won renown in the War of 1812 as the Chesapeake or Baltimore clipper. The true Yankee clipper rejoiced national pride by making speed records seldom equaled before or since by any sailing vessel; 300 miles a day was not exceptional.

Decline of the Sailing Ship

Yet the heyday of the Yankee clippers was brief. They were doomed by the steamships, which were beginning to ply the ocean in greater and greater numbers. Fleet and beautiful, they marked the closing chapter in the long and glorious era of the supremacy of sails and wood upon the seas.

But sailing vessels continued to play a minor rôle in the performance of the world's work. The square-rigger virtually disappeared, and the schooner took its place. Fore-and-aft rigged, with two, three, or more masts, schooners can sail much closer to the wind than square-rigged ships, and can be worked with smaller crews. Schooners were employed chiefly in fisheries, in the coasting trade, on inland waters, and as carriers of heavy freight such as lumber, ore, and coal. The United States at present has the



A FULL-RIGGED SHIP

Sailing ships may be divided into three distinct classes—the square-rigged, the fore-and-aft rigged, and the mixed-rigged. The square-rig, which is illustrated above, consists of sails hung from horizontal yards, which are slung at their middle points to the masts. The masts are held in place by shrouds attached to the ship's sides, and by stays between the masts and forward. A full-rigged ship —a "ship" in the technical sense—has three masts, all square-rigged, called from bow to stern the foremast, the mainmast, and the mizzenmast. A "brig" has only two masts, the fore and main.

A full-rigged ship may carry five or more sails, one above the other, on each mast. The same names are applied to the corresponding sails and spars on each mast, except that the name of the mast is prefixed. In describing the rigging of a ship we shall refer to the foremast, but in every case in which a corresponding spar is used on the main or mizzenmast the number of the corresponding spar will be given, so that you can locate, for example, the fore topmast (6), main topmast (11), and mizzen topmast (16).

Each mast comprises five separate parts or masts. The bottom one is called the foremast (5), mainmast (10), or mizzenmast (15) as the case may be, and the upper ones, in order, are the topmast (6, 11, 16), the topgallant mast (7, 12, 17), the royal mast (8, 13, 18), and the skysail mast (9, 14, 19).

Square-rigged ships usually carry a set of triangular sails called jibs, hung on stays strung from the foremast to a jibboom (2), and to a flying jibboom (1), which project from the bow. Below these spars is a boom called the dolphin-striker (4); it supports the stays and martingales that brace the jibbooms from below. The bowsprit (3) supports the jibboom. Other triangular sails, called staysails, are rigged on the stays between the masts.

The lowest yards are called the foreyard (20), the main yard (27), and the crossjack (34). They carry the foresail, the mainsail, and the mizzen sail or crossjack. These sails are often called courses. Next above these are the lower topsail yards (21, 28, 35), then the upper topsail yards (22, 29, 36), the lower topgallant yards (23, 30, 37), the upper topgallant yards (24, 31, 38), and the royal yards (25, 32, 39). The topmost yards are the skysail (26, 33, 40). On the mizzenmast are a number of special arms—the spanker boom (43), the spanker gaff (44), and the monkey gaff (45).

The fore-and-aft rig consists of one large sail to the mast. This may be spread between a horizontal boom at the bottom and a shorter gaff above. The gaff is a spar fastened to the mast by a collar; it points midway between horizontal and vertical, and can be raised and lowered by halyards. The sail swings to one side or the other of the mast, or directly back of it ("aft"). Such sails can be handled from the deck, so that a large vessel may be manned by comparatively few men.

The single-masted "fore-and-after," with a gaff mainsail and a jib, is called a "sloop"; with two or more masts, and a jib, a "schooner." A sloop with a smaller second mast is called a "yawl."

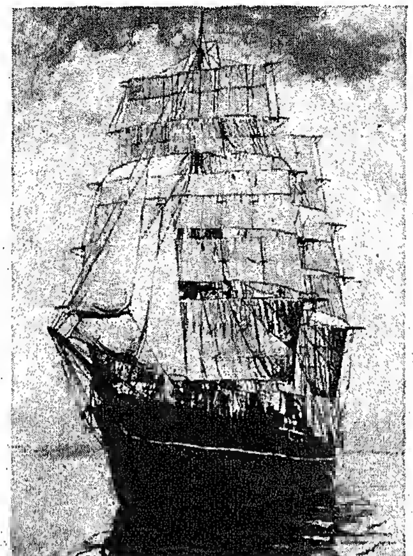
Vessels with mixed rigs, the third class, carry both square and fore-and-aft rigging. A two-master with square rigging on the foremast, and fore-and-aft rigging on the main, is a "brigantine." A threemaster with square rigging on the fore, and fore-and-aft rigging on the other two, is a "barkantine"; if only the mizzenmast is rigged fore-and-aft, it is a "bark" or "barque."

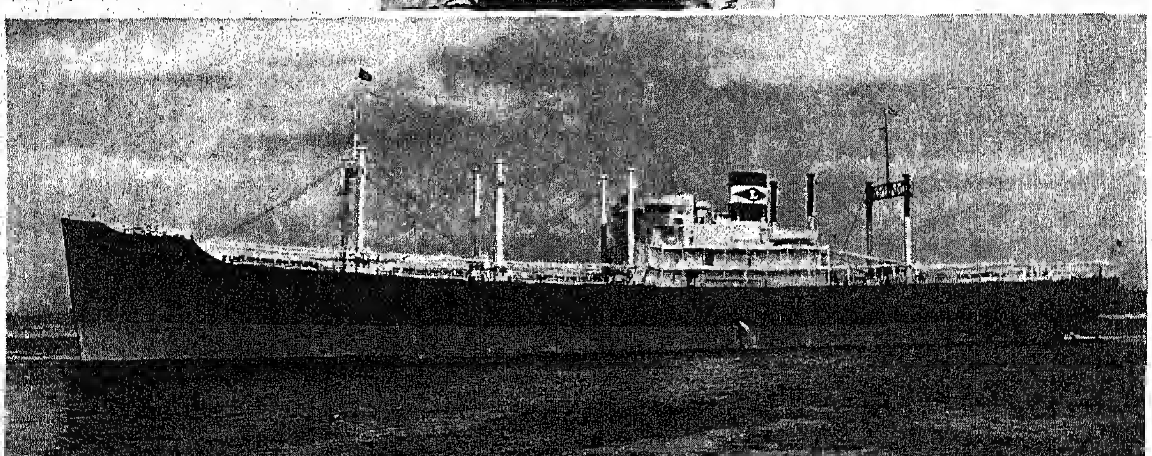
largest sailing tonnage (though not the largest number of sailing vessels) of any country in the world.

Development of the Steamboat

In the closing decades of the 18th century many experiments were made with steam propulsion of boats. Twelve years after Fulton's *Clermont* made its first voyage on the Hudson (*see* Fulton, Robert), the first vessel fitted with steam power crossed the Atlantic. This was the American built *Savannah* which in 1819 ran from Savannah to Liverpool in 25 days, most of the time, however, under sail. The engines of those days consumed about four times as much fuel as modern engines for every horsepower produced, so the problem of a transatlantic steam passage was a fuel problem. The *Savannah's* voyage and the one or two transatlantic passages made by steam vessels in following years made such slight impression that in 1835 "sober sensible people" hooted at the suggestion of a steamship line between Great Britain and North America; one might as well talk of running a steamship line to the moon, they said. And a boat from the moon could scarcely have created a greater sensation in 1838 than the arrival, on April 22, in New York harbor of the *Sirius*, which had made the run from Cork in 17 days entirely under steam power. The following day the *Great Western*, the first steamship built for transatlantic service, arrived from Bristol. And now the transatlantic steam liner was an accomplished fact, and before long the "seven seas" were netted with steamship lines. The only one of the early transatlantic lines to survive, however, was the Cunard line, founded in 1839. The White Star, which merged with the Cunard line in 1934, was originally a sailing line. Its first steamship crossed the ocean in 1870.

SAIL AND STEAM

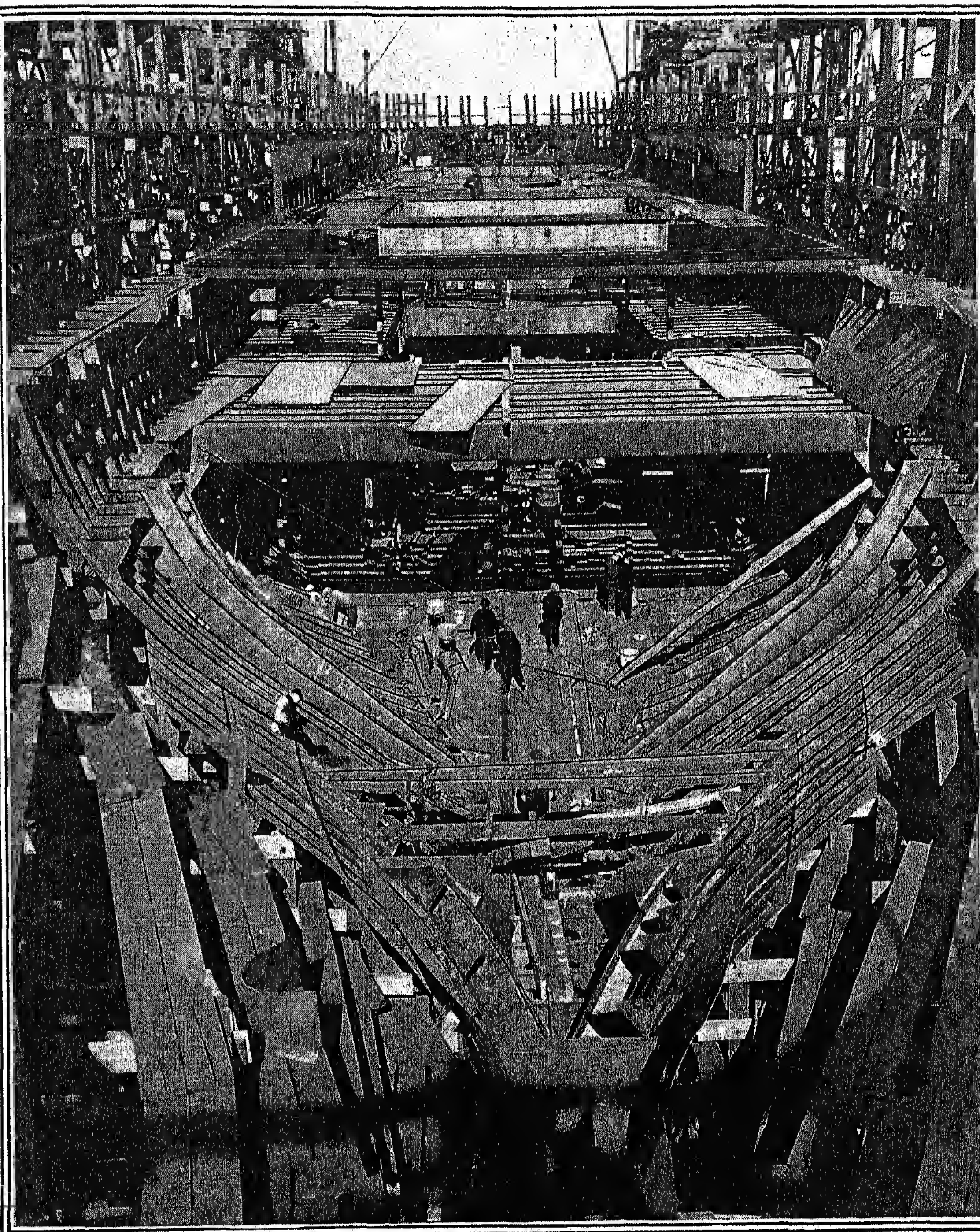




Here we see the past and the present in seafaring. In the stately bark *Discovery*, at the top, Captain Scott made his first attempt to reach the South Pole. The *Frederick Lykes*, in the lower picture, is one of the United States Maritime Commission's C-3 type of vessel. It provides fast cargo service on regular runs and carries a limited number of passengers. The comparatively small superstructure, in which are the officers' quarters and passengers' cabins, allows maximum space for cargo holds.

The fastest sailing vessels as a rule made the voyage from Europe to America in several weeks. One sailing vessel made the passage from Liverpool to Baltimore in 14 days 9 hours. Less than a hundred years from the time of the *Savannah's* voyage the fastest steamships were to make it in four and a half days. The first transatlantic steamships, to be sure, were not infrequently beaten in races with the swift sailing packets. Even today, the hourly speed at which it is found most profitable to run ordinary freight steamships—9 to 12 nautical miles—is no greater than that of the clipper ships—12 to 15 miles—and far below the record clipper speed—21 miles. It is only our great luxurious passenger liners, which disdain freight almost altogether, that make speeds of from 25 to 30 nautical miles an hour. Yet, from the first, commerce tended inevitably to flow in the channels provided by the new steamship lines; and today the London merchant gets tea from China in five weeks by steamship, whereas the fastest of the tea-clippers took at least three months. Steamship voyages are enormously speedier than sailing voyages, even though there may be no such excessive difference in the speed per hour. The overwhelming advantage of steam over commerce is its comparative freedom from delay by adverse weather conditions and its ability to take

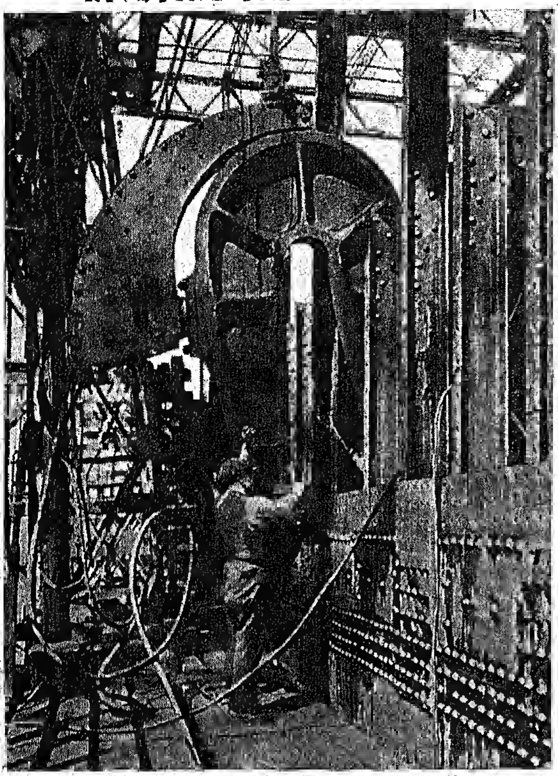
BUILDING A SHIP—THE SKELETON



Here the skeleton of a ship is taking shape on a shipway in a yard. Since construction started in the middle, the nearer end is still open, and the interior is visible. In the foreground at the bottom, the sides are rising from the keel. Nearest us are some outer plates, which make up the sheathing or "skin" of the ship. Inside them are some of the curved frames, which strengthen the sides. A little farther away we see some cross-wise beams, *running from side to side* to strengthen the frames and support the decks. Another important feature is shown just beyond the nearest man, at the left. Here we see how some of the frames are close against the outside sheathing, while others are placed farther in. When plates have been laid on these inner frames, the space between these plates and the outer sheathing will form a double bottom. This will keep out water, if the sheathing should be pierced. Notice also how the two decks are pierced with openings, one above the other. Through these openings, or hatchways, cargo can be placed on any deck. The openings are named for the hatches, or covers, which will be in place when the ship is at sea. Only a few vertical pillars are used. This leaves the holds, or cargo spaces, clear to receive cargo of any shape or size. To aid in construction, the growing vessel is surrounded with scaffolding, and cranes swing in material from the permanent structures of the shipway. The scaffolding will be removed when the time comes to launch the ship.

advantage of the shortest routes. A sailing vessel bound from New York to Rio de Janeiro would first sail east almost across the Atlantic to near the Azores,

RIVETING THE STEEL SKIN



The rivets which hold the steel plates together are driven while red hot. Over 650,000 rivets are needed in the construction of an average 10,000-ton ship; it is said that "the history of steel rivets is the history of the steel ship business."

and then turn south, taking advantage of the trade winds to reach Rio; a steamship would be able to take the most direct route.

Almost parallel with the rise of steam power, an equally important revolution in construction was under way. The early steamships were built of wood, but experiments in the use of iron for the hulls of vessels had been made even before the end of the 18th century. Between 1845 and 1880 iron came more and more into general use, gradually superseding wood for large vessels. The Cunard line was still building wooden ships when in 1850 the Inman line of iron screw steamships was inaugurated. The first steel steamboats were built in the 1850's for the exploration of African inland waters. Not until the '70's was steel used for ocean-going vessels, but from 1880 on, steel gradually replaced iron, until today "steamship" practically means "steel ship."

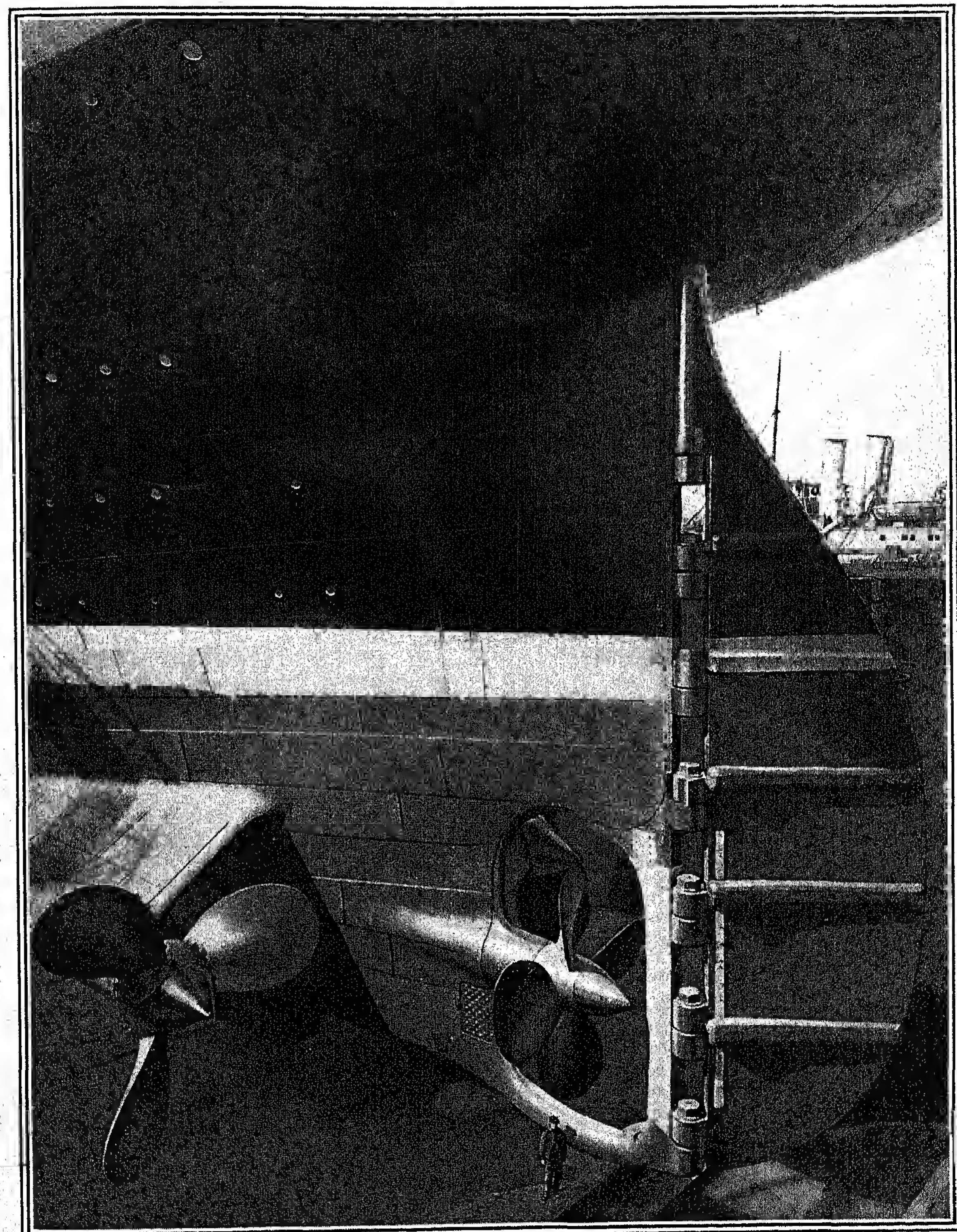
"Will iron float?" jeered passersby at the builder of the first iron vessel. "Pitch your tea cans into the canal and see," he replied. Actually, an iron or steel vessel is not only stronger but lighter than a wooden vessel of the same size, though wood resists a crushing force better than metal, and wooden ships are therefore favored for polar exploration and voyages in polar seas where icebergs and floes are to be feared. Some of the earliest iron vessels built floated scatheless off after buffeting on shoals in storms in which wooden ships quickly went to pieces. Iron construction, it has been estimated, saves 30 to 40 per cent over the weight of wood, and steel saves 15 per cent over the weight of iron. This means increased carrying capacity and lower freight rates. Moreover, steel can be more securely riveted than wood; a large steel ship shows less tendency to sag in the middle or to droop at the ends than a wooden one of the same size. Welding instead of riveting transforms it practically into a piece of solid steel. Therefore the only limit on the size of modern steel ships is virtually the size of the harbors and docks which receive them.

The Decline of American Shipping

Steam and steel ended the fleeting golden age of the American merchant marine. There were other contributory causes for the decay of American shipping, including the disasters it had suffered during the Civil War, the attraction of American capital and labor into new and more profitable fields as the western states were opened up, the opening of the Suez canal, which gave Europe a shorter and cheaper route to the East, and the unequal conditions under which American ships competed with subsidized foreign shipping. But the decisive factor was the advanced state of the British steel industry, which was ready at the time of the revolution in shipbuilding to employ Bessemer's discovery (*see* Iron and Steel) in the construction of ships, while the American steel industry was several decades behind.

The *Clermont* and all later steamboats for many years were propelled by paddle wheels, which are well adapted for the propulsion of light draft boats over smooth shallow waters (some of the early river captains boasted that their boats could run "on a heavy dew"), but are less efficient than the screw propeller in deep waters. An American inventor, Col. John Stevens, had worked out the principles of screw propulsion of steam vessels even before Fulton's memorable first voyage on the Hudson, but American tools and machinists were not then equal to reproducing Stevens' beautiful models. So the first ocean screw steamships were built in England between 1836 and 1839 by an Englishman, F. P. Smith, and a Swede, Capt. John Ericsson, later of *Monitor* fame (*see* Ericsson, John). Paddle wheels would have offered an inviting target to an enemy in war; the advantage of the screw propeller, placed below the water line, quickly appealed to American and British naval authorities. Merchant vessels generally were slower to discard the paddle wheel, chiefly because the marine engines then in use could not economically drive screw propellers. About four years after "Inman's iron screws" were placed in service, the compound engine (*see* Steam Engine)

HOW THE OCEAN GIANT IS PUSHED AND GUIDED

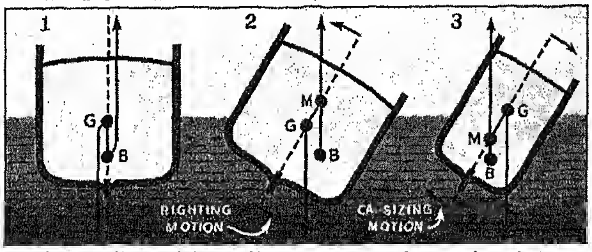


The tiny figure of the man at the bottom of the picture will help you to realize how enormous are the rudder and propellers of a big modern ocean liner. The rudder alone weighs 70 tons—as much as a small locomotive. As the ship plows its massive way through the waves, the helmsman turns a small wheel high up in the wheel-house; instantly powerful machinery obeys the command and twists the rudder post, swinging the great rudder on its hinges with the smoothness and accuracy of a watch. The three giant propellers, projecting at the ends of their powerful steel shafts, likewise obey the touch of the engineer's hand, threshing the water with their curved blades to drive the vessel forward or reversing to check it suddenly in its headlong course.

was adapted to marine use and the screw propeller was adopted on most ships. Twin screws came later; today some vessels have three or even four screws.

Later, more efficient and economical power was obtained with triple-expansion engines and finally with the turbine (*see* Turbine). The first steamship to have a turbine was the experimental *Turbinia*, in 1897. In 1907 the *Mauretania* was completed with these engines and proved sensationally speedy. It made some crossings between New York and Europe at better than 26 knots, or more than 30 statute miles an hour. The *Mauretania* remained speed champion of the North Atlantic until the German ship *Bremen* beat it in 1929. Such successes made turbines the favorite engine for the largest and heaviest ships. In some modern ships the turbines are used to generate electric power instead of driving the ship directly. Early in the 20th century, steamships met a rival in the motor ship, equipped with Diesel engines (*see* Gas Engine).

WHY A SHIP RIGHTS ITSELF OR CAPSIZES



A ship's ability to right itself depends upon the relations between the center of gravity (G), where the ship's weight draws it down, and the center of buoyancy (B), where the water supports the ship. In an upright ship (1), these centers lie on the midline. When a ship rolls, the center of buoyancy shifts sidewise and thrusts upward across the midline at a point called the *metacenter* (M). If the metacenter is higher than the center of gravity (2), the upward and downward thrusts act together to right the ship. But in a top-heavy ship (3), the metacenter may be lower than the center of gravity. Then the two thrusts act to capsize the ship.

Diesel Engines and Oil Fuel

Diesel engines need no boilers, and the space thus saved can be used for cargo. Also, they are more economical of fuel and need no lengthy "warming up," as a steam engine does, before a voyage can start. By the end of the first World War in 1918, the Diesel engine was favored for all cargo vessels and for all but the largest and swiftest passenger ships.

The steam engine later regained some favor, when it was improved by the use of extremely high boiler pressures and oil fuel instead of coal. Before the change to oil, 140 men worked three or four days to coal a large liner for a voyage; after the change, seven men could fill the oil tanks in six hours. A few men tending oil burners replaced 150 firemen shoveling coal. Space rated at 1,000 tons was freed for cargo. Navies use oil fuel whenever possible, both for economy and space saving and because vessels can refuel at sea from tank ships (*see* Navy).

Economy in fuel is of great importance, because the fuel bill may run from one-fifth to one-third of the entire cost of a voyage. The quantity of fuel burned mounts rapidly as speed increases. One vessel may burn 260 tons of fuel a day for a speed of 16½ knots; another not half so large may burn 316 tons to make 19 knots.

The Ancient Art of Shipbuilding

From early ancient times to our own day, the shipbuilder has always had to solve a three-part problem. His ship must have buoyancy enough to support its load. It must be seaworthy. It must have speed enough to do its proper work, whether in carrying passengers as rapidly as possible, in carrying cargo at a reasonable pace, or in meeting the complex demands of naval warfare.

Almost until the time of the American Revolution, these problems were worked out by "cut-and-try" methods. Designers followed successful older models closely and were timid about making changes. The American colonists learned this kind of shipbuilding from the English; but they proved more daring than their teachers. By the time the United States became a nation, some of the world's best vessels were the product of American shipbuilding.

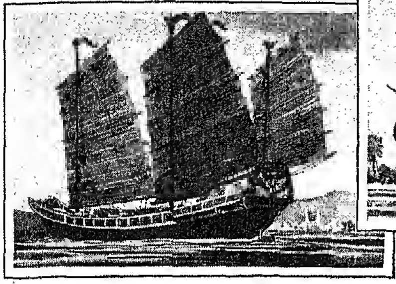
The work was altogether a local industry in shipbuilding towns. The boys who loitered in the shipyards after school, watching a ship grow under the skilful hands of their friends and neighbors, expected themselves to build such ships or sail in them. Many of the workmen were old sailors. The owner's daughter might pose as a model for the figurehead shaped by the woodcutter in the corner of the yard. Most of the workmen were artists in their way, taking pride in the work of their hands and competing jealously for the more difficult tasks. Until about 1830 any skilled shipyard mechanic performed any and all work involved in the construction of a ship. Thus the industry was itself a school for all engaged in it, and continually built up designing and building skill.

Modern Scientific Shipbuilding

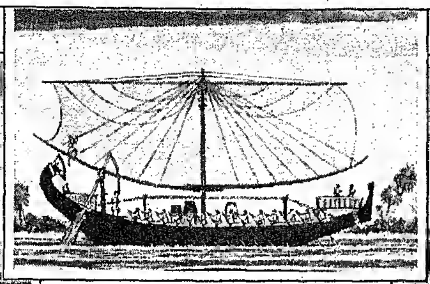
During this time, the swift advance in scientific knowledge was helping shipbuilders to escape from "cut-and-try" methods. An example of this new knowledge is given in the accompanying diagram, which shows how designers work out the problem of stability—that is, how to build a ship that will return to the upright position when it has been heeled over by high winds or rough seas. The change to scientific methods became complete with the use of steel and steam or motor power. The effect of this change can be seen by visiting any modern shipyard.

As we approach, our ears are assailed by a terrific clamor of crashing metal, from which presently we are able to pick out individual notes—roaring foundries, clanging engines, whirring dynamos, and thundering pneumatic hammers. At the water's edge, the cranes and scaffolding of the ways form a rough pattern of colossal steel lacework. Underfoot, instead of the springy carpet of spicy chips and shavings covering the ground in the wooden shipyard, we find a strange litter of heavy metal parts—steel plates and bars,

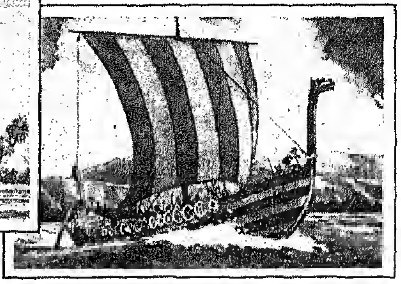
SAILING SHIPS THROUGH THE CENTURIES



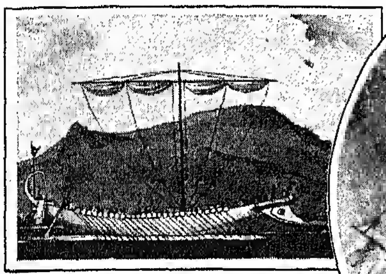
CHINESE JUNK



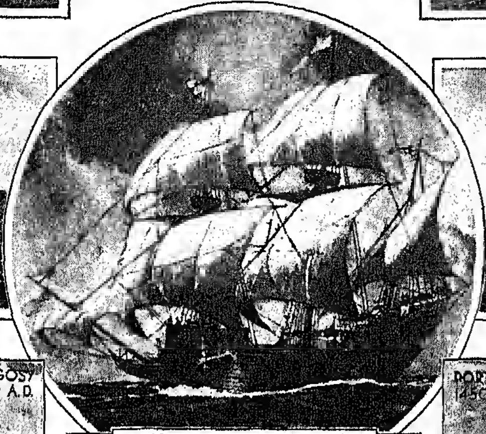
EGYPTIAN SHIP - 1600 B.C.



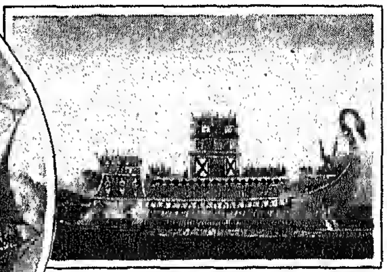
VIKING SHIP - 1000 A.D.



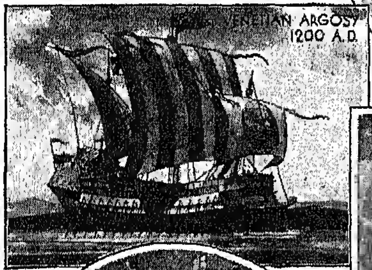
PHOENICIAN GALLEY - 450 B.C.



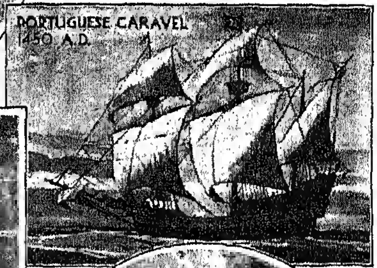
SPANISH GALLEON - 1580 A.D.



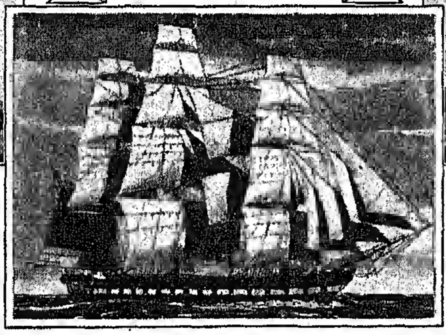
ROMAN TRIREME - 100 A.D.



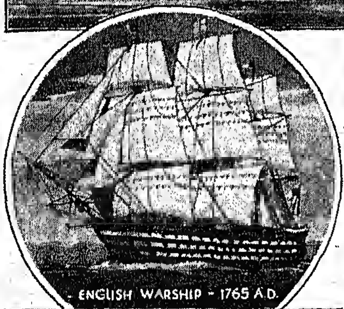
VENETIAN ARGOSY 1200 A.D.



PORTUGUESE CARAVEL 1450 A.D.



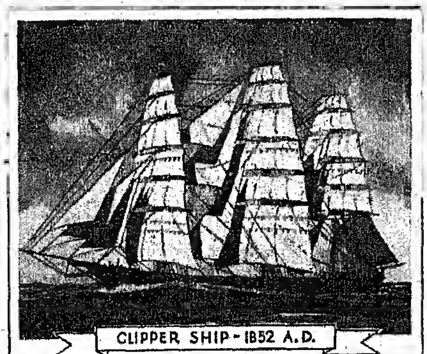
AMERICAN FRIGATE CONSTITUTION - 1800 A.D.



ENGLISH WARSHIP - 1765 A.D.

DUTCH MERCHANTMAN - 1650 A.D.

BARKANTINE - 1840 A.D.



CLIPPER SHIP - 1852 A.D.

FISHING SCHOONER - MODERN

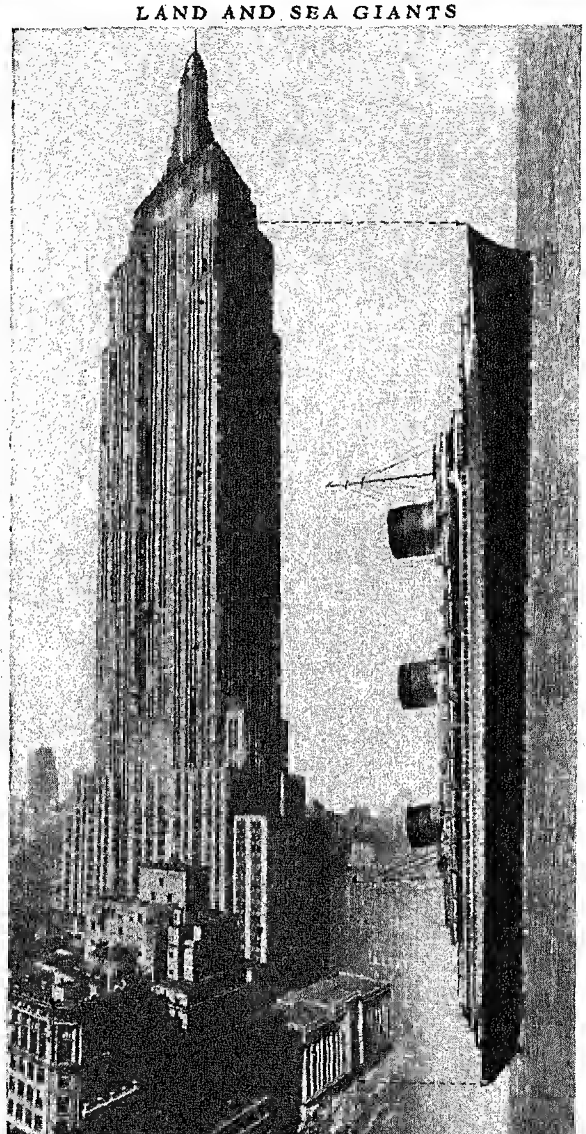
From the hollowed-out log canoes of the first adventurous voyagers by water, to the graceful swift clipper-ships of the 1850's, stretches a span of time that we cannot even guess. But during those thousands of years, with all their ingenious development of form, there were only two methods of propulsion—first oars, then oars and sails or sails alone. In the pictures above are many of the types of ships developed before the coming of steam navigation at the beginning of the 19th century. The Chinese junk is undated because there has been little change in its design for 2,000 years or more. Note the development of rigging, from the simple sails of the early Egyptians and Phoenicians, and even the Vikings, to the fine billowing sails of the frigate *Constitution* ("Old Ironsides") and the fast-speeding barkantine and clipper ship, almost the last champions of sail on the high seas.

iron chains, etc. As various and, to many of us, as unfamiliar are the tasks of many of the men we see at work in the open air or in the vast interiors of the sheds and mills—furnacemen, rollers and flangers, punchers, shearers, acetylene cutters, electric welders, machine riveters, chippers, calkers, yard riggers, besides clerks, draftsmen, electricians, carpenters, machinists, painters, and unskilled laborers, employed on various specialized tasks. When the whistle blows and the 5,000 and more employees of the yard surge forth for the mid-day meal, we see as motley a mingling of races and nationalities—not only Americans, Englishmen, and Irishmen, but Scandinavians, Greeks, Portuguese, Italians, Slavs, and negroes. Most of them know as little about the ships on which they are engaged today as they did about the bridges, the sky-scrapers, or the roads on which they were employed a few days or weeks ago.

In normal times, such data as tonnage requirements, speed desired, and depth of water in the harbors which the ship is intended to frequent are given to the designer of the ship to be constructed. He first calculates the displacement and then determines length, beam, and depth. From this start he works out his design. This practise is modified when ships are needed in huge numbers, as they were during the first World War. At this time standardized designs were largely used, instead of having a marine architect work out an individual design for each vessel. This saved time, just as it saves time for a dressmaker or tailor to use a standardized design or pattern for clothes instead of designing each individual garment separately.

The drawings or blue prints of the design, made to scale, are re-drawn full size on the floor of the mold loft. This room (usually the top floor of the largest building in the yard and 100 feet wide and several hundred feet long—large enough to take in the full-size plan of a liner or battleship) has a specially prepared floor, as smooth as a school blackboard. From the drawings on the mold-loft floor, full-size wooden or paper patterns, called "templates," are constructed for each piece of steel to enter into the vessel. On each template every rivet hole, bend, flange, or angle line is accurately indicated. The ship-fitter transfers these marks to the steel plate, which is then taken to the steel mill to be cut, bent, punched, and shaped in accordance with the indications of the template.

LAND AND SEA GIANTS

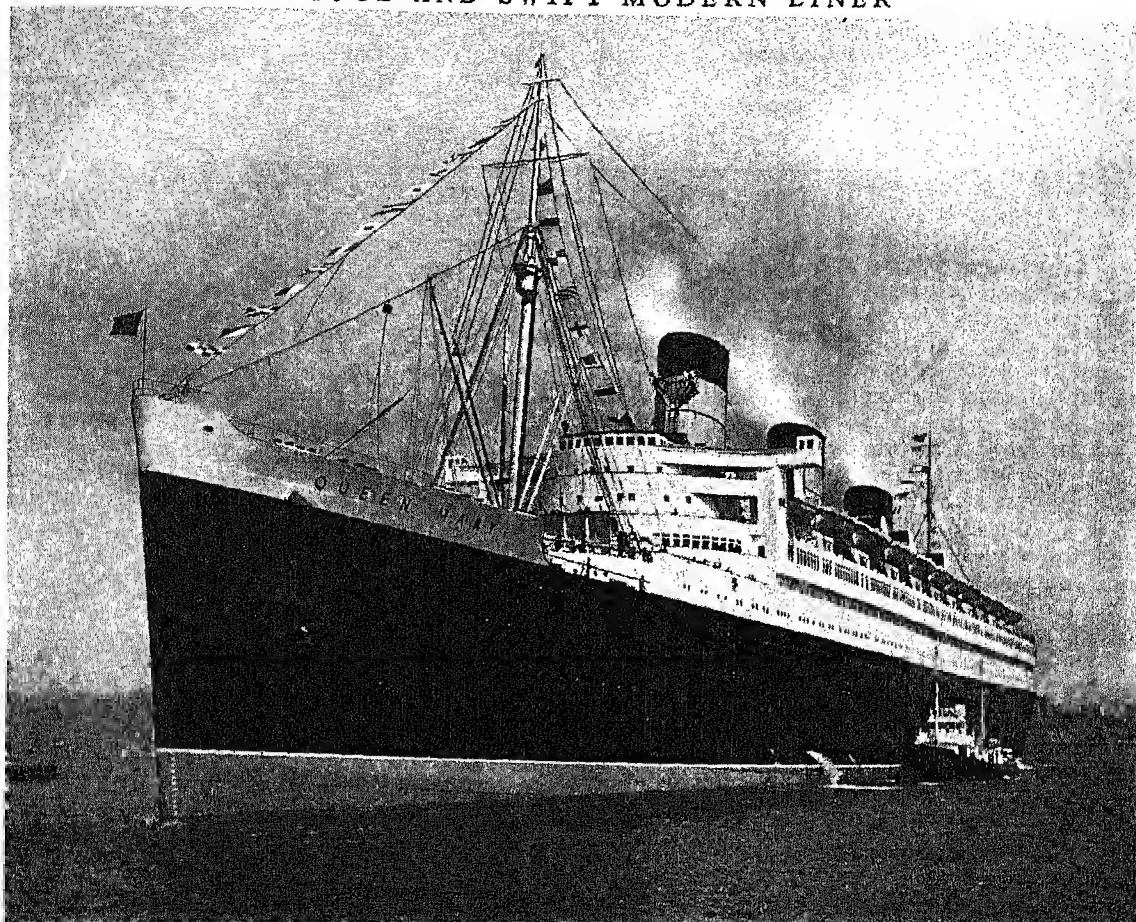


Here we see how the giant *Normandie*, 1,029 feet long, would look if stood on end alongside the 1,250-foot Empire State building. This building is the only man-made land structure whose height exceeds the length of the greatest ships.

Even this work is reduced greatly in wartime by building fabricated ships, as the United States did in the war emergency of 1918. They represented the supreme effort to speed up steel ship construction. In the rigorously simple design of the fabricated ship—mainly tankers and certain kinds of freighters—every unnecessary curve—every non-essential of whatever kind—was suppressed, and the parts, so far as possible, were turned out in quantity, shaped, punched, and prepared for use, instead of being prepared in accordance with specifications as needed, just as the parts of ready-made garments are cut and prepared by thousands. The fabricated ship, in fact, was a "ready-made" as contrasted with a "made-to-order" ship, and this enabled the United States to build an unprecedented tonnage of vessels, both for the first World War and again when emergency need arose in 1940.

The actual construction of the ship begins with the laying of the keel. First, the berth for the ship is prepared at the water's edge. Keel blocks—short heavy timbers with the upper surface shaped to the

A HUGE AND SWIFT MODERN LINER



The *Queen Mary*, completed in 1936, was designed to make speed enough so that, with a sister ship operating on alternate runs, the Cunard Line could offer a weekly passenger service of the fastest class between Europe and America.

keel line—are set up with a very slight incline toward the water. On this is laid the keel, composed of a number of bars or thick plates of heavy steel, each perhaps 40 or 50 feet long, riveted together to make the desired length and thickness. While the frames are being built up from the keel and the plates are being riveted in place, temporary staging is erected inside and outside the hull as needed.

The steel plates which form the shell of the ship are laid, like giant fish scales, 20 to 40 feet long, in overlapping horizontal rows called "strakes." They provide the main strength of the hull, being merely supplemented by the frames. The seams of wooden ships are calked with oakum and pitch; steel ships are calked by driving down the overlapping edges of the upper plates so that they "bite" the plates below. In some of the latest vessels they are electrically welded instead of riveted, producing practically a solid metal shell.

Large steamships are built today with double bottoms, which lessen danger in case of accident. The space between the bottoms, in which a man can almost stand upright at the center of the hull, is used for ballast or for storing fresh water for the boilers or oil for the engines. Still more important for safety are the bulkheads or crosswise and lengthwise vertical partitions which divide the hull into watertight compartments. The more numerous these compartments, provided they are really watertight, the less the danger of sinking. The main lengthwise bulkhead is of special value also in counteracting the tendency of the ship to sag in the middle or to "hog," as drooping at the ends is called. Of particular importance is the "collision bulkhead" in the bow, which is built especially strong to withstand ramming and to confine the damage to that part of the ship if the bow should be stove in. The doors in the bulkheads are watertight and provided with closing apparatus electrically controlled from several central stations, so that any or all can be closed in a second by pushing a button.

The hull is usually launched as soon as it will float; construction and fitting are finished in the water. The launching must be as carefully planned as

the building, because ships have been wrecked by mishaps in launching.

Building Ships for Different Tasks

Vessels are given special designs to suit their work. Warships have always been in a class by themselves (*see* Navy). Most merchant ships are passenger or cargo vessels. The most important types are described in the accompanying table.

The cargo vessels used on the Great Lakes are shaped like long boxes, with flat sides and bottoms, except at the bow and at the stern. Opening the hatches on the long deck lays bare the entire hold. Gravity chutes can fill this space with 12,000 tons of ore in two hours, and huge clamshell grabs can remove the load in eight or ten hours (*see* Great Lakes).

Many cargo ships have refrigerated holds, kept cold by brine circulating in pipes, for carrying meat, vegetables, and fruit. On shallow rivers and some lakes, paddle wheels are used instead of screw propellers. The "whaleback" type of vessel has a cigar-shaped hull which allows waves to sweep over without doing damage.

The *ferryboat* is a special type of vessel. It has one or two broad decks to accommodate heavy loads of passengers and motor vehicles. Often both the nose and the stern are squared off, to fit snugly into landing slips. Car ferries have tracks on the lower deck to carry freight or passenger cars (*see* Railroads).

FACTS ABOUT MODERN SHIPS

Types of Modern Steamships

Express Liners ("Ocean Greyhounds")—The largest, fastest type of ship; speed, 25 knots or better; gross tonnage from about 25,000 up; luxurious passenger quarters with accommodations divided into *cabin* (formerly first class), *tourist*, and *third class;* practically no cargo space.

Combination Ships—Passenger accommodations similar to those on express liners, but ample space for cargo. Wide range of sizes; speeds from 15 knots upward. The United States Maritime Commission's C-3 type of combination vessel accommodates from 60 to 96 passengers, and carries about 10,000 tons, or about 680,000 cubic feet, of cargo at a speed of 16½ knots.

Cargo Ships (Modern Types)—From 5,000 gross tons upward; speeds from 12 knots upward. The Maritime Commission's C-1 type has a cargo capacity of 7,786 tons, or 450,000 cubic feet, and makes 14 knots. The C-2 type is intermediate between the C-1 and the C-3 combination vessel.

Tankers—Similar to cargo ships, except that cargo space is fitted with tanks and necessary equipment for carrying petroleum or other liquids in bulk.

Largest Ships

Queen Elizabeth—British, about 85,000 gross tons; overall length, 1,030 feet; beam, 118 feet. First voyage (wartime), March 1940.

Normandie—French, 83,423 gross tons; overall length, 1,029 feet; beam, 118 feet; 160,000 horsepower. First voyage, 1936. Taken over by United States in 1941 and renamed *Lafayette*. Swept by fire and capsized 1942.

Queen Mary—British, 81,235 gross tons; overall length, 1,018 feet; beam, 118½ feet; 200,000 horsepower. First voyage, 1936.

Speed Record (Passenger Ships)

Set by the *Queen Mary* 1938; westward, 2,907 nautical miles, Bishop's Rock to Ambrose Lightship, 3 days, 21 hours, 48 minutes; speed, 30.99 knots; eastward, 2,938 miles, 3 days, 20 hours, 42 minutes; 31.69 knots.

The Men Who Work the World's Ships

When a ship puts to sea from any civilized land, it carries a highly organized crew commanded by *licensed officers*. The officers include the captain, or master, and his assistants (called either mates or officers), the chief engineer, and the assistant engineers. Each of these men must have a license, acquired by passing an examination by the government or other authority, after a certain length of service in lower grades.

Under the officers come two classes of men. The deck force consists of able-bodied seamen (A.B.'s) and apprentices. The able-bodied seamen hold certificates and do the more responsible work, such as keeping lookout, tending helm, and making difficult repairs. The engine room force under the engineers consists of oilers, who help tend the engines, and firemen. A cargo vessel's crew is completed by a radio operator, a steward, one or more cooks, and perhaps a mess boy. A passenger vessel carries the same kinds of workers but in much larger numbers, especially stewards.

A ship's crew is divided into groups called watches. Formerly all ships had two watches. While one watch operated the ship, the other rested. The watches changed at midnight and every four hours thereafter until 4:00 P.M. Then came two "dog watches" of two hours each. Thus the watches traded hours of duty for the following 24 hours and each watch had its fair share of the more pleasant hours. In emergencies or for heavy tasks, of course, the order "All hands!" summoned the entire crew. All American ships except the smallest types were required by the Merchant Marine Act of 1936 to carry officers and men enough for three watches. Each watch serves two turns of four hours each.

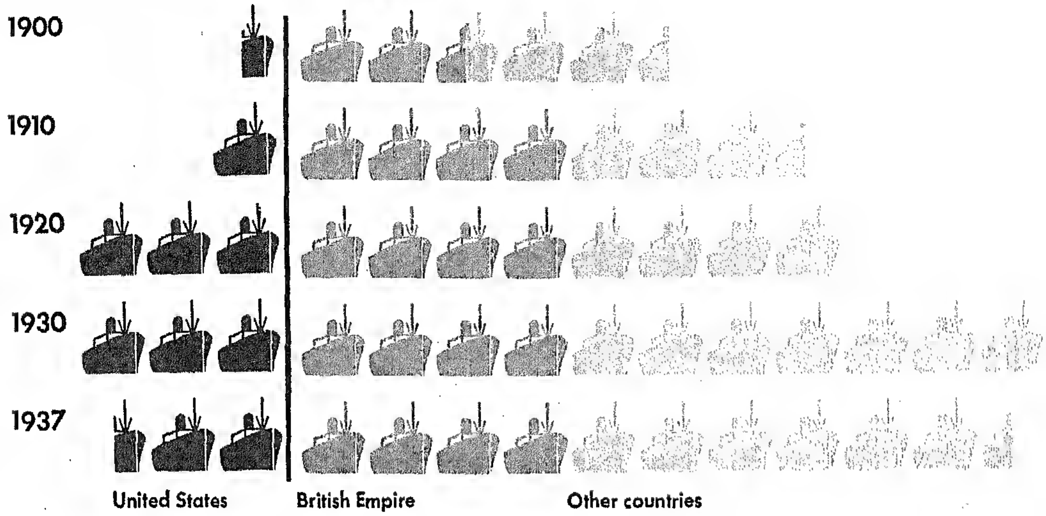
Safety at Sea

The principal law regulating safety at sea is an international convention accepted by the United States and proclaimed in effect on Nov. 7, 1936.

This law requires certain safety features, such as bulkheads and a double hull, which vary with the size of the vessel and the number of passengers carried. Ships must always have a certain freeboard; that is, the sides must stand a certain height above water; the amount varies with the season and in different oceans. Many ships show the required freeboard with a *Plimsoll mark* on the side.

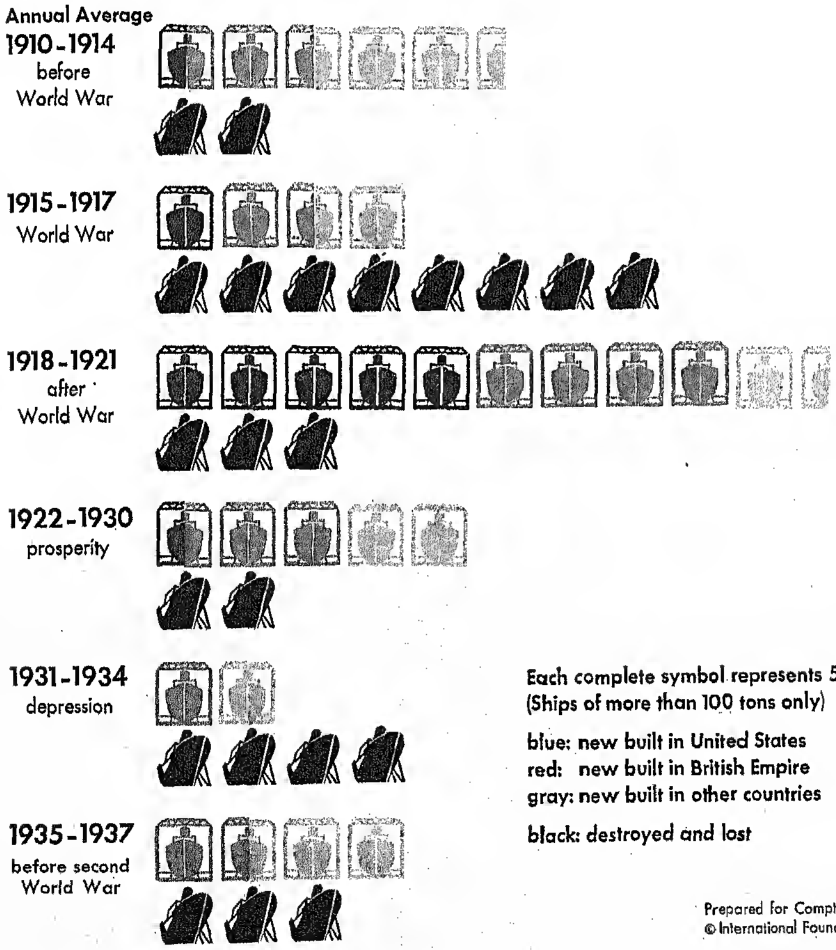
A life preserver and lifeboat accommodation must be provided for every person on board, except on ferryboats and excursion steamers making short trips. These may carry rafts instead of lifeboats for part of the passengers. At night a ship under way must display a green light to the right, or starboard side, and a red light on the left, or port, side. Steamships must also carry a white light on each of two masts. During fogs, vessels under way must signal with a whistle, foghorn, or bell every two minutes. Anchored ships must give two signals close together every two minutes.

Merchant Marine of the World



Each complete symbol represents 5 million gross tons (Ships of more than 100 tons only)

Ships Built and Destroyed (Tonnage)

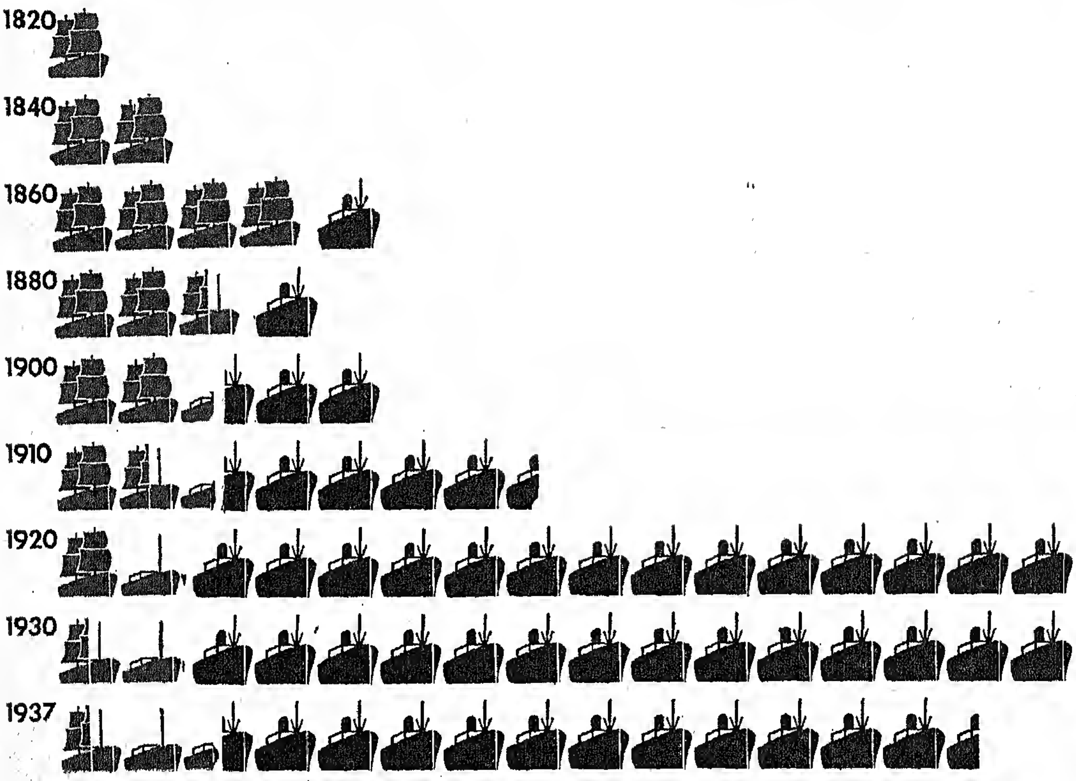


Each complete symbol represents 500,000 gross tons
(Ships of more than 100 tons only)

blue: new built in United States
red: new built in British Empire
gray: new built in other countries

black: destroyed and lost

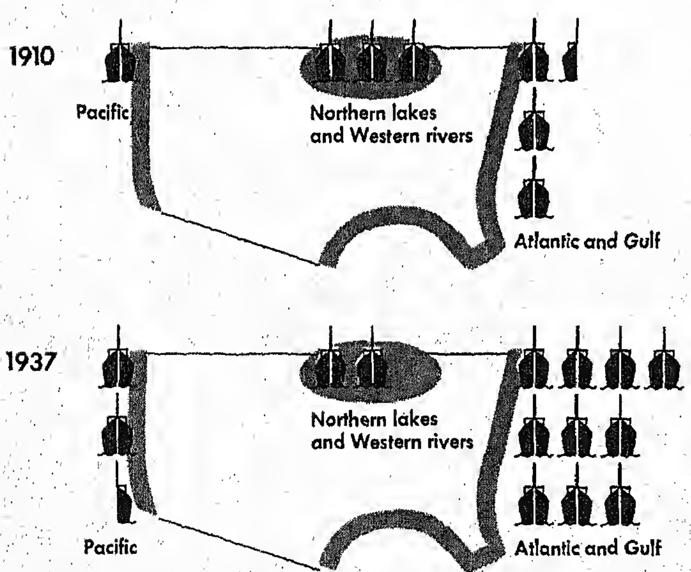
United States Merchant Marine



Each complete symbol represents 1 million gross tons

blue, with sail: sailing vessels
blue, without sail: canal boats and barges
black: steam and motor vessels

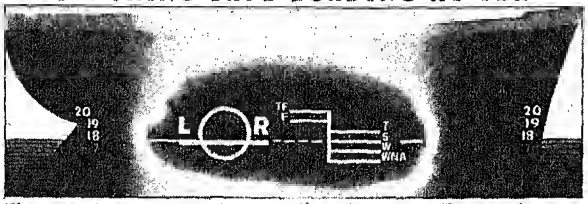
Home Waters of United States Merchant Marine



Each complete symbol represents 1 million gross tons

Vessels are inspected periodically to ensure their compliance with these requirements. Crews must be drilled frequently in safety measures such as fighting fire and launching lifeboats. Other safety aids are the provision of good harbors and proper aids to navigation (*see* Harbors and Ports; Navigation).

INSURING SAFE LOADING AT SEA



These marks help prevent overloading of vessels. The numbers on the water line at the bow and the stern tell how deep the vessel is in the water. Here the depth, or "draft," is 18 feet. The central symbol is a *Plimsoll mark;* it is placed on each side. The circle is one foot in diameter, and "LR" means "Lloyd's Register." The second symbol shows how high the water line can come up the sides when the vessel is loaded for voyages in different regions, as follows: TF, tropical fresh water (rivers and lakes); F, other fresh water; T, tropical seas; S and W, other seas, summer and winter; WNA, winter in the North Atlantic. The last prescribes the lightest loading to insure maximum freeboard, or height of side above water, for safety in this stormy area.

Shipping Costs and Services

Ships give the world its cheapest form of transportation. Flour can usually be shipped from the United States to northern Europe, or even to Shanghai, for about 1/5th of a cent a pound; the United States can bring a bulk cargo of iron ore from Chile or wood pulp from Sweden at about the same rate.

These low shipping rates enable nations to buy wherever goods can be produced at least cost, and to specialize in those products for which they are best suited. Europe can buy meat, grain, hides, and wool from Argentina and Australia and pay with manufactured goods. The United States can exchange foodstuffs, manufactures, and common metals for rubber, coffee, tea, and silk. (*See* Commerce; International Trade.)

A SPEEDY BOW

This express liner, seen in dry dock, has a slim, fast shape and a streamlined bow, with a bulb at the foot. This shape is better than the old knifelike prow for cutting the water and reducing drag along the sides.

These exchanges are carried out by three kinds of shipping service. Companies which have business enough may operate their own ships; much of the world's petroleum is carried in company-owned tankers. For general passenger and cargo service, shipping companies operate "liners" sailing on regular schedules, wherever steady business exists. "Tramp" steamers carry single cargoes and seasonal business.

When war broke out in Europe in 1939 and destroyed much of the world's shipping, there were in existence nearly 70 million tons of merchant vessels. Great Britain owned nearly one-third of this total. The United States owned 20 per cent; Japan, Norway, Germany, and Italy, between 5 and 10 per cent each; and the Netherlands, France, Greece, Sweden, Soviet Russia, and Denmark, from 1 to 4 per cent each.

The American Merchant Marine

American shipbuilding may be traced back to 1607, when the members of a projected colony on the Kennebec River in Maine built the *Virginia*, a 30-ton pinnace, and sailed in it to England rather than face a Maine winter. Commercial shipbuilding and seafaring began in 1631, when the colonists of Massachusetts Bay launched the 30-ton *Blessing of the Bay*. Thereafter these activities grew rapidly in New England. (*See also* American Colonies.)

After the Revolution, American seamen rapidly built up a world-wide trade. The most conspicuous achievements were in trade with the Orient. Boston ships developed a trade route around Cape Horn to the northwest Pacific coast of North America, to obtain otter skins and other furs, and thence to China, where they traded the furs for a return cargo of tea and silk. The first of these voyages was made by the *Columbia* of Boston in 1787–89; but before this, in 1784–85, the *Empress of China* of New York had carried the American flag around the world. In 1816 United States ships entered the packet service between New York and Liverpool, carrying passengers, mail, and express on fast, regular voyages. The time averaged from 20 to 24 days eastbound, and from 33 to 39 days westbound; but many voyages were faster. On Mar. 8, 1824, for example, the *Emerald* reached Boston 17 days after leaving Liverpool.

American seafaring reached its highest success in the clipper-ship days of the 1850's. Thereafter the American flag almost disappeared from the high seas, because the United States could not build and operate steamships as cheaply as European nations could.

The lack of needed merchant ships during the World War of 1914–1918 led the government to aid shipping in various ways, and in 1936 a Maritime Commission was set up to help build an efficient merchant marine. It was authorized to regulate working conditions and provide for training personnel; to loan money for shipbuilding; and to give subsidies to shipbuilders to take care of the difference between foreign and domestic costs of building and operating vessels.

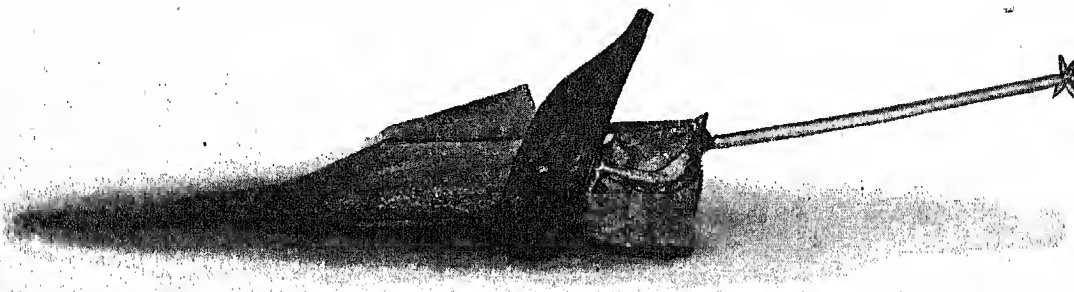
Laws Governing Crews

Law requires 90 per cent of the crew on all vessels except the smallest to be American citizens. Aliens are permitted only as stewards on passenger ships. Crews must be signed on before a government official. The La Follette Seamen's Act of 1915 and later laws ended many old abuses. They abolished imprisonment for desertion and corporal punishment, and provided that a crew's quarters must have at least 16 square

feet of deck and 120 cubic feet of air for each individual, setting a good standard of sanitation and comfort. They provided also for medical attention, and for a good quality of food.

A ship's size and capacity are expressed in terms which are somewhat confusing unless certain distinctions are kept clearly in mind. "Displacement" or "displacement tonnage" is the weight of the water which the ship displaces —in other words, the weight of the ship itself. "Dead weight tonnago" is a ship's maximum carrying capacity, or the difference between its displacement light and its displacement loaded to its limit. Passenger and freight liners are seldom or never loaded to the limit of their capacity, and the term is not used in connection with them, but chiefly as a basis for charges on tramp steamers chartered to carry heavy commodities. "Gross tonnage" is defined as a ship's total measured cubic contents (in actual practice certain spaces are excluded from measurement in ascertaining gross tonnage) in "tons" of 100 cubic feet each. The official United States mercantile marine statistics are estimated on the basis of gross tonnage. "Net tonnage" is what remains of gross tonnage after deduction of space for fuel, machinery, crew's and officers' quarters, and other spaces devoted to purposes necessary for operation of tho vessel. It is sometimes estimated that net tonnage averages about two-thirds of gross tonnage, but the ratio between gross and net tonnage varies widely in individual vessels; net tonnage may be very insignificant in an "ocean greyhound." The basis for tonnage dues is net tonnage, which is necessarily calculated according to arbitrary rules. There is a story of a man who, feeling injured at the tonnage dues on his vessel, built one in which the net tonnage, calculated according to the established rules, was a minus quantity, and who accordingly maintained that the harbor authorities owed him money whenever he left port.

FOOTWEAR—*From the* ANCIENT SANDAL *to the* MODERN SHOE



An Early 15th Century Shoe, with Stirrup and Spur

SHOES. Man is the "tenderfoot" among animals, so in very ancient times he began to fashion some sort of foot covering for protection from the burning sands and the stony ground. The animals could leave all this to nature, for they were provided either with soft cushions like those on the feet of the cat or with horny hoofs like those of the horse.

Man's earliest footwear was the sandal. Mats of woven grass, strips of hide, or flat pieces of wood to protect the soles of the feet were fastened by thongs over the foot, or sometimes brought up between the toes and bound around the ankle. In time, more material was added to cover the foot, either for decoration or for protection from the cold, and the sandal became the shoe. The Greeks and the Romans worked out a variety of decorative sandals, and some of the Roman styles approached the shoe form. In colder regions some of the first shoes were mere bags padded with grass and tied about the feet. Sometimes the skins of animals were made into moccasins or clumsy boots.

Sandals are still worn by a great many of the people of the Orient, and moccasins and soft skin boots are today made and worn by Indians and Eskimos. Another odd shoe still in use is the wooden shoe cut out of a solid piece of wood, worn by the peasant in Holland and other parts of Europe. The "clog" shoes worn by some of the millworkers of England and elsewhere have wooden or metal soles.

Modern footwear had its beginning in the Middle Ages. In the feudal days, the craftsmen who fashioned the footwear for the castle lords and ladies were very important personages. Substantial footwear was necessary in the cold northern climates, and persons who took part in the Crusades or went on long pilgrimages needed durable shoes. Furthermore the barons and knights paid a great deal of attention to their appearance, and to please them their craftsmen showed great individuality in working out a variety of slippers, shoes, and boots. Some were made with and some without heels. Some were adorned with great buckles. Fashions ran to ridiculous extremes. In the 13th and 14th centuries it was fashionable to wear long narrow-toed shoes; the higher the rank of the wearer, the longer the toes. When the toes grew to excessive lengths they were looped up and tied at the knees. Such shoes were cumbersome and awkward and were also very wasteful of material, so laws finally put an end to the style by threatening to fine and punish the wearers. High leather boots were fashioned as a protection to the leg after the knights ceased to wear full armor, and the height of the boot and the manner of its adornment came to indicate the importance of the wearer.

In all this rivalry of shape and fashion very little was done to make the shoe comfortable or to shape it to the foot. A boot or shoe would fit either foot, and it was not until about 1785 that in England a "right" and "left" last was used. More recently a great deal of study has been given the problem of securing the greatest foot comfort. This is especially true of army shoes, for it is very important that marching shoes for the soldiers be correctly built so as not to cramp or blister the feet on long marches. The later development in the industry has been chiefly in making shoes which are both comfortable and attractive, and in turning them out in such quantities that the price may be lowered.

SANDALED FEET OF THE ROMAN

These two Roman sandals, that once trod London streets in the days when Rome ruled the world, were dug up in a deposit of peat in the Moorgate district of London.

Shoemaking as a business was introduced into America in 1629, when Thomas Beard, a shoemaker, arrived under contract to make shoes for the Pilgrim colony. In the pioneer days shoes were valued for their warmth and durability rather than for their style; but the trade soon developed so that the American shoes were said to compare favorably with those of the old country.

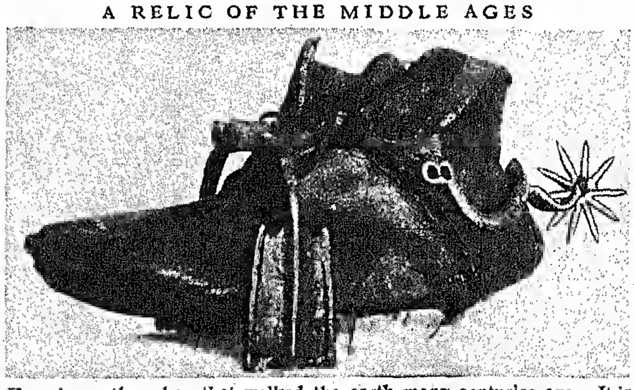
A young man desiring to learn the trade in those days would apprentice himself to a shoemaker. After he had learned the trade and had served his apprenticeship, he would become a journeyman. For a time he might go about from one family to another and from one town to another carrying his crude tools with him. Later he would settle down in business for himself as a shoemaker and cobbler or would become a hired workman in a large shoemaker's shop.

At first one man did all the work on a pair of shoes. Early in the 19th century, however, many shoemakers found that they could increase their output by dividing the work. They employed assistants to specialize on such tasks as cutting uppers or putting on soles or making the leather smooth and strong by beating it on a lapstone. This specialization was the start of the factory system in the shoe industry.

About the middle of the 19th century, the shoe industry throughout the world was revolutionized. As a result of a series of great inventions in the United States hand labor was replaced with amazingly ingenious machines. The first was a "roller" machine, invented in 1845, to displace the lapstone and beating hammers. An even greater labor-saving device, the sewing machine, was soon developed by Elias Howe, and was used to stitch uppers of shoes. In 1858 Lyman Blake made an equally remarkable advance when he adapted the sewing machine for stitching uppers to soles. This largely eliminated the vast amount of labor that had been required when soles and uppers were attached by hand, either with wooden pegs, nails, or hand sewing. This machine was improved by Gordon McKay, who then developed a number of labor-saving devices for the shoe industry. Late in the century another great advance was the machine brought out by Charles Goodyear, Jr. Its curved needle made possible the machine-production of "welt" shoes, a high-grade type in which no stitching appears on the inside of the sole.

So rapidly did other inventions arise that the shoe industry today is one of the most highly mechanized of all industries. Some factories employ as many as 170 processes, a different machine being used for each process. With machine production, it is possible to make a pair of shoes in 15 minutes, whereas, under the old system of hand labor, the output was only one pair a day for each man.

A RELIC OF THE MIDDLE AGES



Here is another shoe that walked the earth many centuries ago. It is a shoe of the Middle Ages and was found with the iron stirrup and spur in digging a ditch in the Newgate district of London.

In manufacturing, shoes are classified according to whether the soles are sewed, cemented, or nailed to the uppers. The cementing process, which was used in a small way as early as 1870, is becoming increasingly popular, especially for women's shoes. Most shoes, however, are still sewed. The nailed process has largely taken the place of wooden-pegging and standard screw-wiring processes in the manufacture of men's work shoes.

Most modern factories are divided into eight general departments—upper cutting, upper fitting (stitching room), stock fitting (sole leather room), lasting, bottoming, making, finishing, and treeing and packing. Uppers consist of vamps, tips, quarters, backstays, and tongues, and may be cut from calfskins, sheep-

skins, goat- or kidskins, horsehide or light cattle hides or, especially in women's shoes, from reptile, ostrich, or kangaroo skin, or from various fabrics, such as linen and satin. In quantity production, upper cutting is usually done by "clicking" machines, which stamp out many pieces at a time. Linings are cut in the same way. Uppers for higher-priced shoes and for women's fancy shoes are often cut by hand.

Machines in the upper-fitting department are marvels of mechanical ingenuity. Keen-bladed "skiving" machines trim off the surplus leather. The uppers pass down a long line of sewing machines which stitch them to the linings, each operator specializing on one seam. Various machines speedily perforate the tips, insert hooks and eyelets, make buttonholes, sew on buttons, and lace the eyelet-type shoe to hold the upper in proper position for further work.

A SHOE OF SAXON DAYS

Shoes like this were worn by the ancient Saxons. They were simply pieces of leather shaped around the foot like the moccasin of the Indian.

While the uppers are being prepared, the stock-fitting room produces the "bottom stock"—outsoles, insoles, welting, counters, heels, and box toes. The counters, which are made of leather or stiff fiber and placed between the upper leather and lining at the heel, protect the foot and help to preserve the shape of the shoe. Box toes serve the same purposes for the front of the shoe. Heels may be made of composition or of layers of leather or, as in many women's shoes, of wood. In the lasting department, uppers, box toes, and insoles are put on a "last," which is a wooden model the size and shape of the foot that the shoe is designed to fit. On the "pulling-over" and "bed-lasting" machines the leather is smoothed, pulled firmly around toe and heel, and tacked in place.

Making the Famous "Welt" Shoe

"Bottoming," or attaching the soles to uppers, is done in many different ways for each class of shoes—sewed, cemented, or nailed. Most sewed shoes, however, are bottomed by either the McKay sewed process or the Goodyear welt method. Many manufacturers consider the Goodyear method to be the best process, as the manner of stitching leaves the inside of the shoe perfectly smooth, and a welt-made shoe is easily repaired. In the Goodyear method the insole is tacked to the bottom of the last. The upper is then drawn over, its edges reaching to those of the insole. A narrow strip called the "welt" is fastened below these, and the outer sole is then sewed to the welt. For cemented shoes, the welt or the margin of the upper is coated with a pyroxylin cement, and the outsole is attached by pressure.

The shoe then goes to the "making" department, where heels are attached by high-speed machines, some of which can heel as many as 1,500 pairs a day. Still other machines then remove all the temporary tacks, and the shoes are sent to the "finishing" department, where the bottoms are scoured, gummed, or waxed, and polished. The lasts are then removed. Cleaning and dressing are done in the "treeing" department. After the shoes are fitted with "findings"—such as bows and laces—they are inspected and packed for market.

"Custom" and "turned" shoes call for a large amount of handwork. Turned shoes, which are made inside out, have no insole, and are usually made of light, soft leather. They are difficult to repair.

Good care extends the life of all shoes. Wet shoes should be dried gradually—never placed on a radiator or stove, because heat will rot leather.

Since the United States led in the development of shoemaking machinery, it quickly became a leader in the industry. Since 1875 it has exported shoes to almost every country of the world, and today its factories have an output far in excess of that of any other country of the world. Women's shoes are first in number and value, and men's second.

Where the World's Shoes Are Made

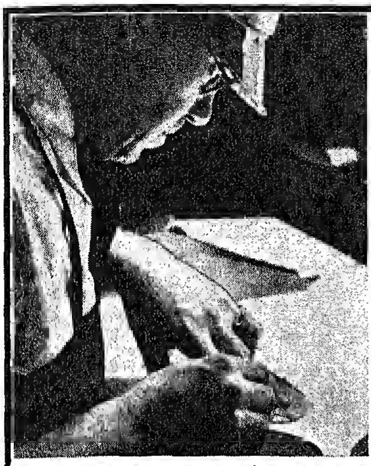
Massachusetts, the birthplace of the shoe industry in the United States, has about one-third of the nation's shoe factories and leads in the manufacture of women's shoes. Other large producing states are New York, Missouri, Illinois, New Hampshire, Wisconsin, Maine, and Ohio. European leaders in the industry are Germany, Great Britain, and Switzerland.

Monopolistic Power of Leasing

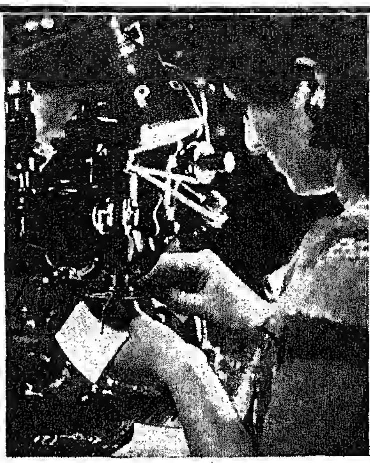
Shoe manufacturers, unlike manufacturers in other industries, own practically none of their machinery. Almost all of the machines are operated on a "leasing" system which grew up when early shoe manufacturers refused to incur the expense of buying Gordon McKay's first machinery. McKay then persuaded them to rent his machines, payment for the use of the machines to be made in the form of royalties. That is the method in use today. Each machine is equipped with a counter which determines the number of shoes that pass through the machine or the number of stitches made on the shoe. The manufacturer then pays a royalty on each operation. The royalties vary from about one twenty-fifth of a cent to a cent and a half for each operation. These royalties amount to enormous sums on the total annual output throughout the industry.

Patents on many of the very important machines are in the hands of a few men and the absolute control of these machines, through the leasing system, puts great monopolistic powers in their hands. The right to continue this leasing system has been contested in the courts, but the system was declared legal. (*See also* Leather.)

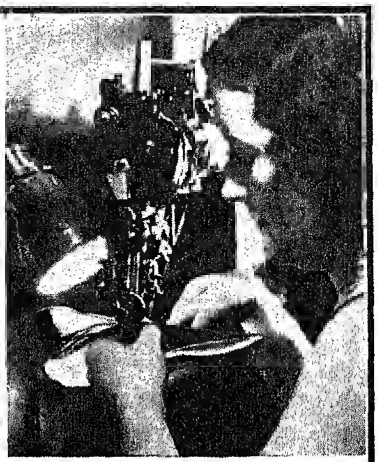
EARLY STEPS IN THE LIFE OF A SHOE



1. Cutting out the leather from patterns. The patterns are made from cardboard with brass-bound edges. Each style and size require from 10 to 16 pattern pieces.



2. Paring down or "skiving" the edges of the pieces of leather that come from the pattern cutter, so they can be sewed together without making too thick a seam.

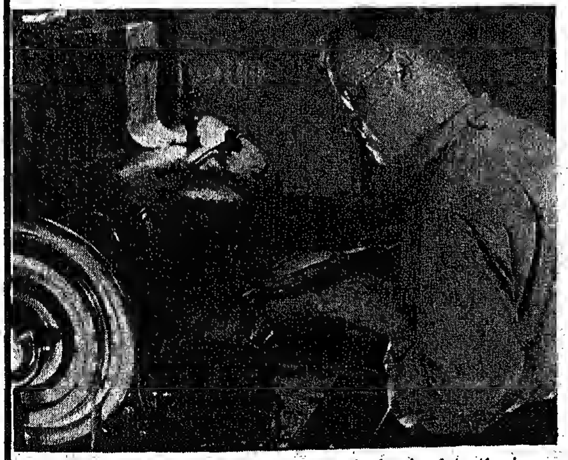


3. Sewing the inside lining to the uppers. The pieces for the lining are cut from patterns out of kid- or sheepskin or out of the kind of cloth called twill and drill.

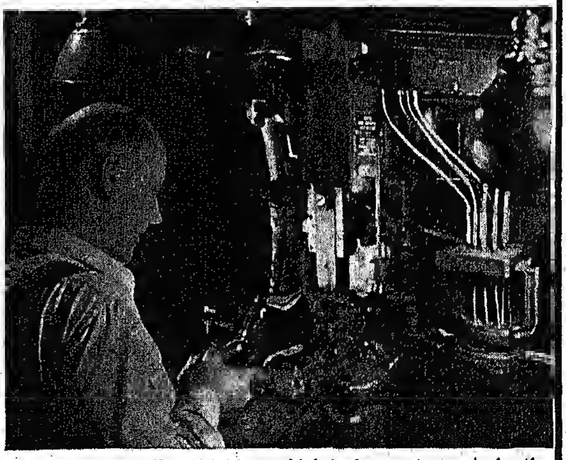
4. The "pulling-over" machine adjusts the dampened uppers over the last to which the inner sole has already been fastened. It also tacks them loosely into place.

5. Next the shoe goes to this bed-lasting machine where the uppers are carefully stretched, formed, and fitted around the toe, the heel, and the sides of the last.

6. While still in the bed-lasting machine the edges of the uppers are folded over and tacked firmly to the last. These tacks are removed after the welt is sewed on.



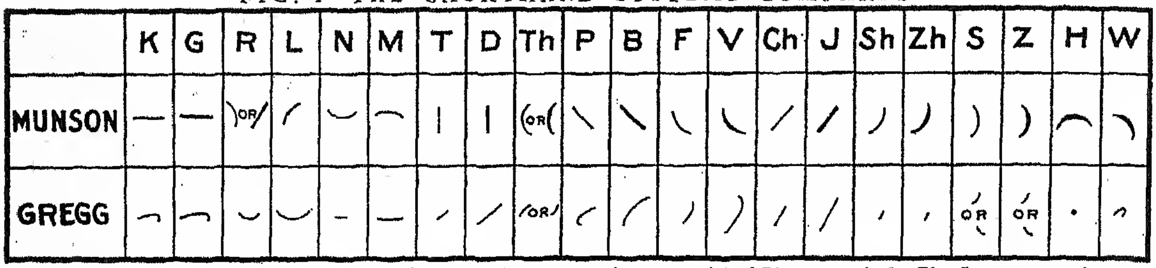
7. With the welt in place, the outer sole is glued to the inner sole with pads between to prevent squeaking, and we see here the stitching which fastens outer sole to welt.



8. This is the heeling machine, which tacks on at one stroke the layers that form the heel. The shoe is now ready for "finishing."
(Photos by courtesy of *Fortune* magazine.)

SHORTHAND. A very rapid writer of longhand can write only about 60 words a minute—a rate wholly inadequate for keeping pace with speech. By the use of shorthand, however, one who has just mastered the art can usually write 100 words a minute, and expert shorthand writers have made records of more than 250 words a minute. The average public speaker, it has been estimated, speaks at the rate of only 120 to 150 words a minute, and usually a business man in dictating his correspondence speaks slowly enough so that even a beginner who has carefully mastered every step in learning shorthand can keep pace with him.

FIG. 1—THE SHORTHAND SYSTEMS COMPARED



The "Munson" system of shorthand, shown above, is a development from the original Pitman method. The Gregg system is comparatively new. By comparing a few of the symbols such as "T," "D," and "W" in the two systems, you can see the differences in character between the methods.

Forms of shorthand have been in use since very early times—just how early we do not know, but we do know that the orations of Cicero were taken down in some sort of shorthand by his secretary, a Greek slave. England is the birthplace of modern shorthand. From the 16th century on, various systems originated there, but it was not until Isaac Pitman in 1837 published the first work of "phonography," or writing by sound, that shorthand became a practical art. Of the several systems which are in general use today, all but one are "Pitmanic," or systems based on that of Isaac Pitman. The exception is Gregg shorthand, a system which rivals the Pitmanic systems in popularity. It was invented by John Robert Gregg and was first published in England in 1888.

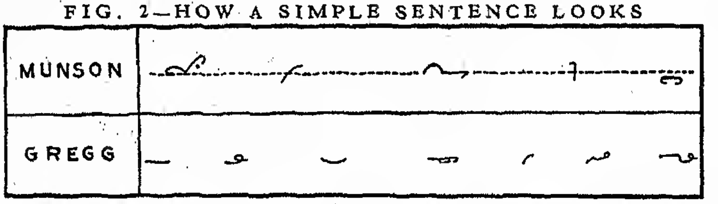
Modern shorthand uses as few strokes as possible to a word, the average number in the practical systems of today being from two to three. The shorthand alphabet includes distinct characters for the representation of consonants, vowels, and diphthongs. Various methods of abbreviation are used, such as writing the most suggestive part of a word instead of the complete outline; using "word-signs," often consisting of a single stroke, for a large number of common words; and using short methods of writing prefixes and suffixes, such as *con*, *inter*, *tion* (*shun*), etc.

Another expedient for gaining speed is "phrasing," or uniting two or more words in one outline.

There are certain fundamental differences between the Pitmanic systems and the Gregg. The former use "position writing," an expedient for expressing vowel sounds without writing them; the principal vowel sound in each word is indicated by the position in which the outline is written—whether above, on, or below the line. The Gregg system abolishes position writing by writing the vowel into the word in its regular order, without lifting the pencil; thus it may be legibly written on unlined paper. Another feature of Pitman shorthand is "shading," the heavy writing of an outline giving a meaning different from that of the same outline written lightly. The characters in Gregg shorthand are unshaded.

The consonant alphabet of the Pitmanic systems consists of straight lines and circular curves; that of the Gregg, of straight lines and elliptic curves. Where it is necessary to express vowels in the former systems, dots and dashes are used; and diphthongs are represented by acute angles pointing in various directions. The Gregg system uses what are called connective vowels—circles and hooks joined to the consonants in the order in which they occur in the word represented; and diphthongs are composed of combinations of circles and hooks. This tends to make the system elastic and adaptable.

FIG. 2—HOW A SIMPLE SENTENCE LOOKS



Here are the characters which the Munson or the Gregg stenographer sets down in a flash to express, "More rain will make the tree green." You will notice, however, that you cannot read either one by simply comparing the characters with those in the table above. This is because stenographers often use only a letter or two for a word—just as the "Gregg" writer used the letter "m" as a "word-sign" for "more."

The accompanying table (Fig. 1) shows the consonants in Munson shorthand (one of the Pitmanic systems) and in the Gregg system, respectively. In the Pitmanic systems *l* or *r* is represented at the beginning of a stroke by a small hook, placed on one side to indicate *l* and on the other side to indicate *r*. In the same way *n*, *f*, and *v* are represented by a small hook at the end of a stroke. When position alone might not make a vowel clear, dots and dashes are used. A heavy dot opposite the beginning (top or left) of a stroke is "ah," at the middle "ay," and at

the end *ee.* A light dot represents short *a*, *e*, or *i*, a heavy dash *aw*, *oh*, or *ooh*, and a light one short *o*, *uh*, or *oo* as in "good."

Let us write the sentence "More rain will make the tree green" in Munson shorthand. It will look like the upper line in Fig. 2. For the word "more" we have the character for *m* preceded by the hook for *r* and written on the line (called "second position") to give long *o*. For "rain" we have the character for *r*, to which is joined the *n* hook, and the heavy dot in the center of the *r* indicates long *a*. The word "rain" is joined to "more" making a phrase. The word "will" is a word-sign—the letter *l* in third position (cutting the line). For "make" we have the letters *m* and *k* written in second position to indicate long *a*. The little downward stroke joined to the *k* is the word-sign for "the," and here we have another phrase. "Tree" is expressed by the letter *t* to which is joined the *r* hook and which is written in third position to indicate long *e*. For "green" the letter *g* is preceded by the *r* hook, followed by the *n* hook, and written below the line (also third position) to indicate long *e*.

Now let us take the same sentence in Gregg shorthand. It appears as is shown in the second line of Fig. 2. The letter *m* is a word-sign for "more." For "rain" we have *r* followed by the large circle, representing *a* and the character for *n*. "Will," as in the Munson system, is a word-sign composed of the character for *l*. "Make" is easily read, by a glance at the consonant table (Fig. 1), and the next character is the word-sign for "the." "Tree" and "green" should offer no difficulty, the small circle in each word representing the letter *e*.

In the last quarter of the 19th century machines for writing shorthand began to appear on the market. Several of these, such as the stenograph and the stenotype, have proved practicable and are extensively used. They are constructed so that all the keys may be depressed at the same time, and a code has been developed so that a whole word may be written at one stroke. When an operator has memorized the abbreviations he is able to acquire as good speed as by the use of shorthand.

SHRIKE. The "butcher-bird," as the shrike is commonly called, hangs his victims—field-mice, frogs, small birds, lizards, or insects—on thorns or barbed wire, or fastens them in a tree crotch, the better to tear them in pieces. This peculiar habit is due to the fact that the shrike's claws are small and weak, and so he must have some way of holding his food while he tears it into pieces small enough to eat.

Shrikes have few likable traits. They are regular Bluebeards and often kill for the mere love of killing. As a family, they are classified with song birds, but the call note is harsh, and only a few species sing.

These birds are about ten inches long. The plumage, never bright, is generally gray or brown, varied with black and white. The sexes are usually alike. The bulky nest is placed in a tree, usually among thorny twigs or intertwining vines. The white eggs, four to seven in number, are spotted with olive brown.

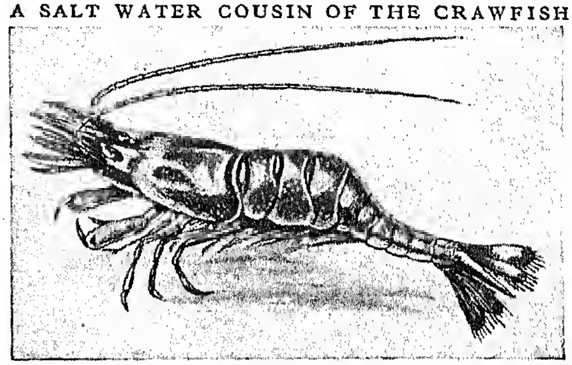
Shrikes are widely distributed throughout the Northern Hemisphere, and in parts of the African and Indo-Malayan regions. In the Western Hemisphere none are found south of Mexico, and but two species occur in America, the northern shrike and the loggerhead shrike. Of these the loggerhead shrike is the more southern form and the best known. (For illustration in color, *see* Birds.)

Of the Old World species the "great gray shrike" of Europe, pearl gray and white, with black wing and tail feathers, is well known. The small "red-backed shrike" is found in Great Britain. The male of this species has a gray head and neck, rust-red back, and pale rose breast; the female is dull brown.

Scientific name of northern shrike, *Lanius borealis borealis;* of loggerhead shrike, *Lanius ludovicianus ludovicianus.*

SHRIMP. Shrimps, of which there are many varieties, are close relatives of the crawfish, belonging to the class of crustaceans. Their home, however, is in salt water. Shrimps are from two to six inches long,

A SALT WATER COUSIN OF THE CRAWFISH



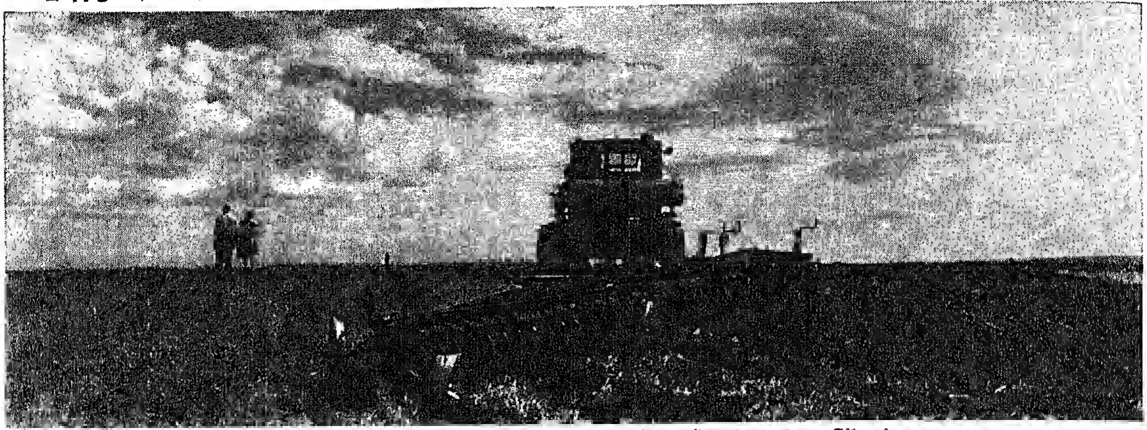
This is what a shrimp looks like in its native waters. When cooked, it resembles a small pink doughnut, because heat colors the flesh and curls up the body. After cooking, shrimps are shelled and the sand vein, or intestine—the dark line running down the back—is removed. The flesh of the shrimp is rich in iodine. This accounts for much of its characteristic flavor. Shrimps and their relatives the prawns are among the most popular of all sea foods.

have paddle-like legs for swimming, long delicate feelers on the head, and a humpbacked grayish-green body ending in a finlike tail. In spring and summer they take to deep water to spawn. Later the young migrate to warm, shallow coastal waters, only to return again to the open sea as they mature.

In the United States the largest shrimp fisheries are off the south Atlantic and Gulf states and on the Pacific coast. Trawling is the method most commonly used by commercial fishermen for taking shrimps. (*See* Fisheries.) Over half the catch is canned. Large quantities are sold fresh and some are dried. Canned and dried shrimps are shipped all over the world.

Shrimps, especially the larger species, are sometimes called prawns. Prawns of tropical waters may reach a length of 20 inches. The scientific name of the common American shrimp is *Crago septemspinosus;* of the common prawn, *Palaemonetes vulgaris.*

The VAST EXTENT *and* RESOURCES *of* SIBERIA



Mechanized Farming on the Wheat Lands of Southwestern Siberia

SIBERIA. Most non-Russians think of Siberia as a land of frozen wastes and snow-covered forests, in which wolves hunt down luckless travelers. They think of it as a region of incredible distances and bitter cold, populated chiefly by wandering tribes, political exiles, and convicts.

These popular ideas have a basis of fact. Northern Siberia has the coldest spots on the globe, and Siberia has been a place of exile for many generations. But Siberia is far more than this. It is to the Soviet Union what the Far West once was to the United States. It is a fast-developing frontier region of immense resources, of varied climates, and of vast possibilities for the future. It has a score of cities with populations of between 100,000 and 500,000, and people are pouring into it as they once did into the American Far West. Mines and forests provide the materials for manufacturing industries that are growing at a prodigious rate.

Siberia is an immense region. It includes nearly a third of all Asia, and it is larger than Europe by nearly a million square miles. From west to east it stretches 4,000 miles, as far as from Seattle to the eastern side of Greenland. But it is still thinly settled. Though it has more than half of the land area of the Soviet Union, it has only about a tenth of the population. (For map, *see* Asia.)

Extent.—West-east, nearly 4,000 miles (Ural Mountains to Pacific Ocean north of Kamchatka); north-south, generally about 1,700 miles. Area, about 4,800,000 square miles; population, about 17,000,000.

Climate.—Average temperature above freezing only from April (in the south) or June (north) to October (south) or September (north). Coldest point, Verkhoyansk, with an annual mean of 3.6° F., a January mean of −58°, and a July mean of 60°. Warmest points, Barnaul and Khabarovsk, with an annual mean of 34° F., a January mean of about −10°, and a July mean of about 69°. Precipitation (mostly in summer months) from 20 inches a year in extreme west and southeast to less than 5 inches a year in northern portion of the Lena Valley.

Cities.—Sverdlovsk (population, 425,000); Novosibirsk (405,000); Omsk, Chelyabinsk, Perm, Irkutsk, Vladivostok, Khabarovsk (200,000 to 300,000); Krasnoyarsk, Stalinsk, Nizhni Tagil, Barnaul, Magnitogorsk, Tomsk, Kemerovo, Ulan-Ude, Prokopevsk, Chita, Zlatoust (100,000 to 200,000); Petropavlovsk, Leninsk-Kuznetski, Bisk, Anzhero-Sudzhensk, Komsomolsk, Uralsk, Cheremkovo, Nadezhdinsk, Blagoveshchensk, Lysva, Kamensk-Uralski (50,000 to 100,000).

Regions, Climate, and Soil

The word "Siberia" has different meanings. The Soviet government uses it to mean only certain administrative regions; but geographers use it to mean all Russian Asia, except the dry region east of the Caspian Sea (roughly, the Kazakh Soviet Socialist Republic and the small republics south of it).

Siberia, in this broader sense, consists of three belts running east and west: Arctic desert in the north, forest in the middle, and farming land in the south. The differences in these belts are caused by differences in climate.

Because of its immense size—one-tenth of all the land of the globe—Siberia is unique in its climate. Because most of it is so far from the ocean, it is little affected by oceanic winds. It makes its own climate, so to speak, and, more than that, it is a principal factor in creating the monsoon climates of China, India, and the Indo-Chinese Peninsula (*see* Climate; Winds).

In winter the land everywhere becomes intensely cold. Indeed, scientists call the region around Verkhoyansk in eastern Siberia "the cold pole of the earth." But the air remains calm, except for occasional blizzards called *burans* or *purgas*. It does not pierce buildings or fur clothing, and the cold is bearable.

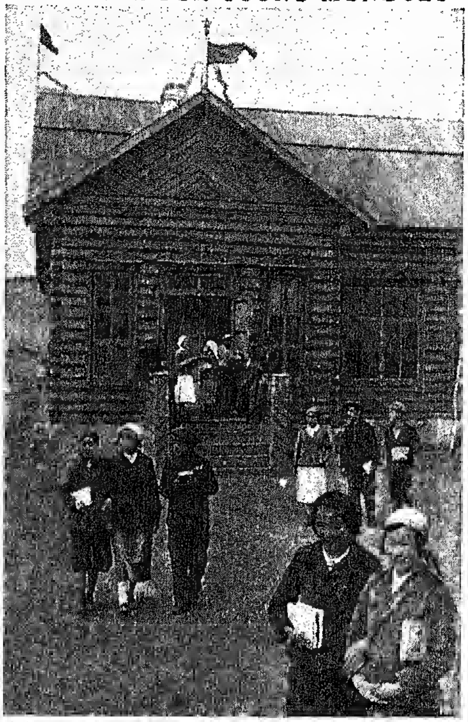
In summer the long hours of sunshine heat the air and make it rise. Heavier, cooler air flows in from every direction, bringing moisture with it. The ground thaws and plants grow, according to the amount of heat received in various latitudes.

In the northern belt of Arctic desert, the surface is thawed for only a brief summer period. Here only mosses and lichens can grow. The middle belt gets warmth enough to grow forests of pine, fir, and larch, with some aspen, birch, and alder. But the soil, as in most pine-forest regions, is thin, acid, and of little use for crops (*see* Soil). In the third belt, the southern, a longer growing season with little rain produces richer soil, and good crops can be grown.

Beneath a thin cover of soil, Siberia is practically one huge slab of rock, which is lowest in the west and northwest, and rises gradually to its edges in the southeast and south. Hence the rivers flow north or northwestward toward the Arctic Ocean, except along the Pacific coast. Around the inner edges of the slab, the highest mountains of Asia are draped in curves. Geologists explain this by saying that this Siberian slab has existed since the early days of the earth, and the surrounding mountains have been pushed up against the edge of the slab.

Minerals are scattered throughout Siberia. The richest deposits are in the Urals in the west. The next richest area lies along the northwestern edge of Mongolia. Coal, iron, and low-grade manganese ores are abundant. Other coal and iron areas are near Lake Baikal, and on the upper Bureya River near Komsomolsk in the Far East. The gold-bearing gravels of the rivers around Yakutsk are exceptionally rich. There are also scattered deposits of lead, zinc, tin, and tungsten. Some petroleum is obtained from Russia's half of Sakhalin Island in the Pacific.

A SCHOOL FOR YOUNG MONGOLS



A log schoolhouse, under the sign of the Soviet star, helps to win children of the Buriat-Mongol Republic to Soviet ways of life.

Peoples and Early Settlement

Before the 17th century, Siberia was inhabited by peoples of Finnish, Tatar or Turkic, and Mongolian types. Finns, Samoyeds, Yakuts, and Tungus lived in the Arctic tundra. The Tatar or Turkic peoples lived in the west. One of their towns, Sibir, near the modern Tobolsk, gave its name to the entire region. The Mongolian peoples occupied the eastern portion.

The first Russian movement to the east was made to beat back the constant Tatar invasions. After Sibir came under Russian rule in 1582, the Russians pushed eastward along the southern belt of good land, engaging in the fur trade. Later, criminals and political offenders were sent into exile along the same route. The region was opened wide to Russian settlement when the Trans-Siberian Railroad was built between 1891 and 1905. Most of the people still live along this railroad and its spurs.

Free peasants were not admitted to take up land until serfdom was abolished in 1861. Thereafter the czars made intermittent attempts to encourage colonization. In all, about a million Russians entered during the 19th century; but only a fourth were free settlers.

Recent Development

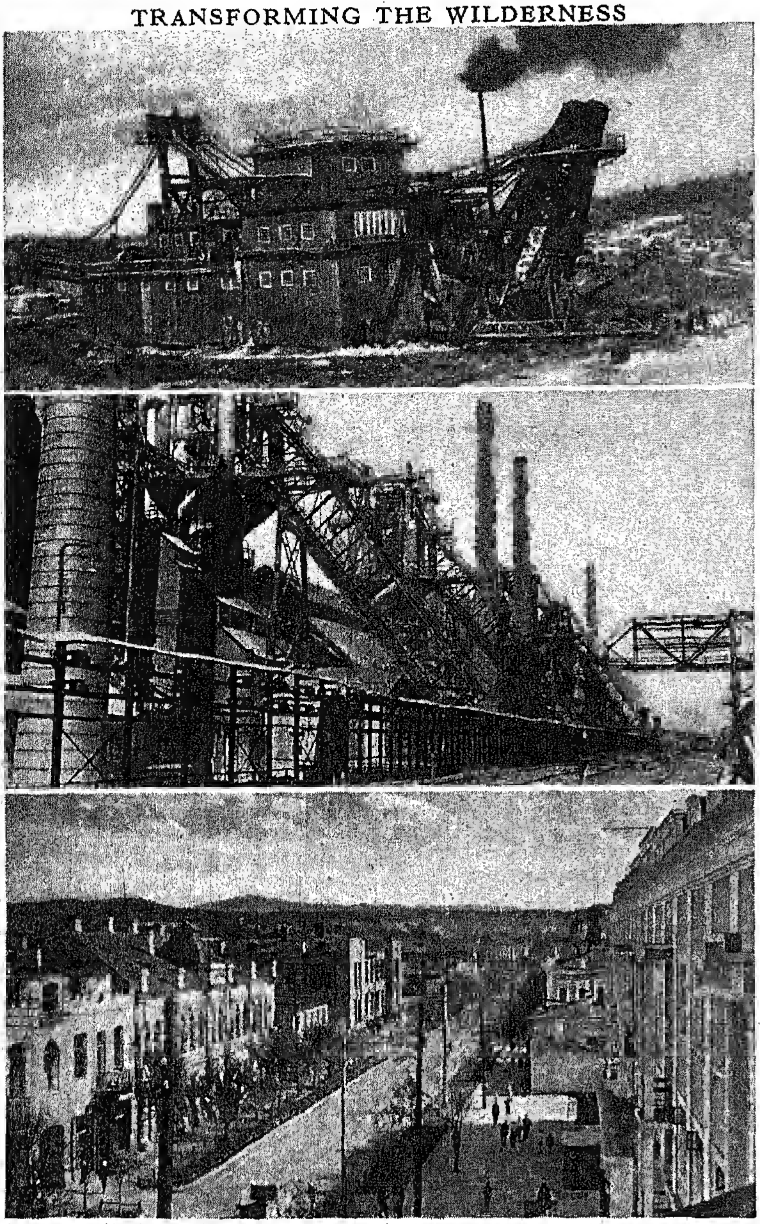
After the Soviet government was established in 1917, it gave intensive attention to Siberia. It wished to develop new centers based on communist principles, to provide land for peasants, and to have sources of military strength far from Europe. From the start, the government dealt intelligently with its three handicaps—diverse races, limited transportation to serve vast distances, and unfavorable climate with only a little good soil. To deal with non-Russian races, it granted considerable local autonomy in government.

Education was encouraged and efforts were made to stimulate native output of furs and foods; but native languages, customs, and ways of living were respected. To promote development of the country, the government added branches to the 3,886-mile main line of the Trans-Siberian Railroad from Chelyabinsk to Vladivostok. It also started a second line from Taishet near Irkutsk to the lower Amur River, as a safeguard against enemy seizure of the vulnerable main line along the upper Amur. To serve northern Siberia, ice-breaking ships

FORMER NOMADS TAKE TO VEGETABLE GROWING

Here the Soviet program for developing Siberia has won over some Mongol women from their ancestral ways to life on a collective farm.

TRANSFORMING THE WILDERNESS



All across Siberia, machinery and towns are transforming regions which once were left to the wolves. At the top a dredge is extracting gold from a river. Below is a blast furnace in the Kuznetsk district near Mongolia. The bottom picture shows Lenin Street in Ulan-Ude, the capital of the Buriat-Mongol Republic.

plied the Arctic Ocean. They delivered supplies and picked up timber, furs, and other products which were moved down the rivers during the navigation season from June to September. Airplane transport was developed to all the principal cities and towns.

To make the best use of the scarce good soil, agricultural experts studied the possibilities of the various regions and started projects to grow suitable crops and animals. Hence there is much specialization in different parts. Chief crops are wheat, especially in the southwest, oats, barley, rye, and vegetables. Dairying has come to be a large industry in the west, and Siberian butter has become world-famous.

Three Great Divisions

Siberia falls naturally into three great divisions—western, central, and far eastern. The western portion extends from the Urals to the Yenisei River. It is drained largely by the Ob River and its branches. Most of it is low, and swampy when not frozen, but it rises sharply in the southeast, up the Russian side of the Sayan and Altai mountains. This mountainous district and the Urals, to the west, are among Russia's richest sources of minerals. The two districts work conveniently together, since the Urals have more iron than coal, while the Sayan-Altai (or Kuznetsk) district has an excess of coal. By carrying iron ore east and coal west, maximum output can be obtained from each district.

In the Urals is the largest city in Siberia, Sverdlovsk. Other centers in the Urals are Chelyabinsk, Perm, Nizhni Tagil, and Zlatoust. Novosibirsk, the point of entry for the Sayan-Altai district, is Siberia's second city. Other cities here are Stalinsk, Kemerovo, Prokopevsk, Leninsk-Kuznetski, and Anzhero-Sudzhensk. From Novosibirsk the Turkestan-Siberian Railroad runs south to tap the mineral wealth in the Kazakh Republic. Important Siberian cities on this line are Barnaul and Biisk. Other large cities of the region are Omsk, Tomsk, and Krasnoyarsk.

The central region is drained by the eastern branches of the Yenisei River and the tributaries of the Lena. This region is mountainous in the south, and it is rugged nearly to the Arctic Ocean. Most of the Lena River basin, with a larger area to the northeast, is organized as the Yakut Autonomous Republic. It is left largely to the native Yakuts and Tungus, except for gold mining, timber cutting, and fur collecting along the Lena and its branches. Coal and petroleum exist in the north.

The most valuable part of this central region is that around Lake Baikal, the largest freshwater lake in Asia (13,200 square miles). Coal and iron support a metals industry at Irkutsk, with related industries at Chita. Near by is the autonomous Buriat-Mongol Republic, with its capital at Ulan-Ude.

The far eastern region comprises the lands which drain into the Pacific. Because of the enormous distance from European Russia, the government has tried to make the region as nearly self-sufficient as possible; but the difficulties are formidable.

Most of the crop-growing land is along the Amur River, and is vulnerable to attack from Manchukuo. The greater part of the Pacific coast is icebound several months of the year; everywhere water pipes must be carried in conduits that can be heated in winter. But despite these difficulties, development has gone forward, particularly along the lower Amur River. Industrial centers have been developed at Khabarovsk and Komsomolsk for smelting iron, refining petroleum from Sakhalin Island, cement making, and other manufacturing. The port at Vladivostok has been equipped with modern facilities and supplemented by new ports at Sovietskaya and Nikolaevsk. (*See also* Kamchatka; Vladivostok; and *see* the entry **Siberia** in the FACT-INDEX at the end of this volume.)

SIBYLS (*sĭb'ĭlz*). According to an old Roman tradition, the Cumaean Sibyl or prophetess came from the east to the Roman King Tarquin the Proud, offering nine books of prophecies but at so enormous a price that he refused to buy. She then destroyed three, and offered the remaining six at the same price, and was again refused. Destroying still another three, she asked as much for the three left and Tarquin's fear and curiosity finally induced him to buy. They contained advice regarding the religion and government of the Romans and were carefully guarded in the temple of Jupiter and consulted on occasions of national emergency. When the temple was burned in 83 B.C. a new collection was made of about 1,000 lines, gathered from all the cities of Greece, Italy, and Asia Minor, which was kept until some time between A.D. 404 and 408, when the Christians caused it to be publicly burned.

Several other sibyls or inspired prophetesses are named by various Greek and Roman writers. Legend said they lived to an incredible age. The Sistine Chapel in Rome contains world-famous wall paintings by Michelangelo of the Cumaean, Delphic, Persian, Libyan, and Erythraean sibyls.

SICILY (*sĭs'ĭ-lĭ*). On the walls of a Moorish palace in the Sicilian city of Palermo runs this legend: "Europe is the glory of the world, Italy of Europe, and Sicily the fairest garden of the Mediterranean." This "fairest garden" is the largest island in the Mediterranean. Mount Etna, which dominates it now as always, looks down upon an unsurpassed panorama of curving bays, shining cliffs, and crowded fishing villages perched like nesting sea-birds among rocks and crags. The landscape shows rugged mountains dark with evergreen, and rounded hills gray-green with olives and terraced vineyards, as well as yellow sun-baked plains and valleys carpeted with orchids, iris, and anemones, and many quaint old towns and cities.

Picturesque towns are these, with their vine-covered walls, their gardens and fountains, and their ancient palaces and churches, flooded with sunshine and the heavy fragrance of flowers. At Etna's foot, on the east, directly across the Messina Straits from the toe of the Italian boot, lies Messina. This great seaport was founded by the Greeks about 600 B.C. under

A RUINED MEMORIAL OF THE DAYS OF THE GREEKS

At Taormina on the east coast of Sicily, you may see these ruins of a theater which was originally built by the Greeks. But while the columns are Greek, the arches you see are Roman, for the original theater was entirely reconstructed by the Romans. From these ruins you get a beautiful view of Mount Etna in the background.

the name of Zancle (the Greek word for "sickle"), referring to its peculiarly shaped harbor. From the earliest times it has been of commercial importance. Even the ancient Phoenician trading vessels threaded their way between the fabled rocks of Scylla and the perilous whirlpool of Charybdis in the straits outside the harbor. Messina today is a wealthy modern city humming with industry. Its inhabitants have shown their pluck in the face of centuries of disasters, culminating in the terrible earthquake of 1908 which almost completely destroyed the city. It is estimated that 76,000 persons were killed, and 95,000 more were injured. Famine and pestilence, following in the wake of the disaster, caused many more deaths.

Near Messina, along the eastern coast, is Taormina, perched on the rocks like an eagle's nest, 700 feet above the Ionian Sea. Far to the south past Catania stretch yellow plains to the famous Syracuse, once the greatest city of Sicily, now reduced to a mere shadow of its ancient splendor. Across a temple-crowned shell-shaped valley on the southwestern coast lies Girgenti. On the northwestern coast at the mouth of the orange-bowered "Golden Shell" valley lies Palermo, the largest city in Sicily. Its population is about 390,000.

Palermo may fittingly be called "the melting pot of the Mediterranean," for the Phoenicians, Greeks, Romans, Goths, Saracens, Normans, French, and Spaniards who have ruled there have all in turn left their distinctive marks on this old city. Its beautiful harbor is filled with fishing boats with bright-colored sails, and great steamers loaded with lemons and sulphur. In the streets tourists mingle with gaily costumed peasants, who look like grand-opera heroes with their bright sashes and gay shirts, proudly riding in their wonderfully carved and gaudily painted two-wheel carts drawn by donkeys covered with plumes and tinseled harness. Palermo has other interests, too, besides its commercial ones. The University of Palermo, founded in 1779, has recently risen in importance and now has more than 1,000 students. The city is a military post and has a large arsenal. Near by is a royal winter palace.

The Power of the Mafia

Because the elementary schooling is so poor many of the Sicilians—especially the sunburnt fishers, mountaineers, and other poor but picturesque peasants—are very illiterate. The poor laborers—notably the sulphur workers—have a very hard time, and they used to go in great numbers to the United States, until that country passed laws restricting immigration after the first World War. The Mafia, a powerful secret organization which terrorized the entire island and even had its agents in the United States, was the curse of Sicily as the Camorra was of Naples, until firm measures taken by the Fascist government broke its power. Scores of Mafia leaders were sent to prison or exile, and the organization's long record of crime and violence was brought to an end, for a time at least.

Sicily's history is a tale of changing masters, of conquests and cruel oppression. It was first great under the Phoenicians nearly 3,000 years ago. With the Greeks, who arrived in the 8th century B.C., came Sicily's intellectual "golden age." The poet Theocritus, the philosopher Empedocles, and other great men of Greece trod her streets, and beautiful Grecian temples were built. Then came the Carthaginians, who soon had to yield to Rome. Vandals and Goths found their way across the narrow straits from the mainland, pillaging and destroying. Then the Byzantine rulers of Constantinople sent armies to drive out the barbarians and held the island against the marauders for a brief period.

With the Saracens in the 9th century came a new epoch. Agriculture, industry, and commerce once more flourished. Then the battle for Sicilian soil began again. First of the invaders from the north were the Normans. Under Emperor Frederick II (1197–1250) Sicily attained what was perhaps the zenith of her culture, at this time becoming, indeed, the cradle of Italian song, and one of the first of modern states. Sixteen years after Frederick's death Charles of Anjou overthrew the last of the Hohenstaufen dynasty, but his cruelty and oppressive taxation greatly angered the Sicilians. Matters came to a crisis on the day after Easter in 1282, when, as the vesper bells were ringing, the people of Palermo massacred 4,000 of their French oppressors. Massacres in other parts of Sicily followed this famous "Sicilian Vespers," after which independent Sicily chose Pedro III of Aragon for king.

A Long Period of Misrule

Spanish, French, and Austrian despots then brought a long period of darkness and stagnation. In 1734–35 Don Carlos established the Bourbon dynasty in Naples and Sicily, uniting the two territories under the name of the Kingdom of the Two Sicilies; and down to 1860 Sicily was governed by Bourbon kings. Then Garibaldi with his thousand "red shirts" came to deliver the Sicilians, finally annexing Sicily to the dominions of Victor Emmanuel, which a year later became the Kingdom of Italy. The island is now divided into seven Italian administrative districts or provinces.

Sicily is separated from the Italian mainland only by the narrow Strait of Messina (*see* map of Italy). It is a fragment of the long narrow land-link which in prehistoric times joined Italy to Africa. Its area of 9,935 square miles is a little greater than that of Vermont. Its chief exports are sulphur, fruits (grapes, olives, oranges, lemons, etc.); fish (a great supply of tunny, sardines, as well as sponges and corals, are taken from Sicilian waters); wine, oil, sumac, and salt. Population, about 4,425,000.

SIEGFRIED (*sēg'frēd*). Long, long ago, in a gloomy cave hidden away in the forests of the Rhineland, there lived Siegfried, a kingly youth, tall and strong, with fair hair and blue eyes. His only companion was Regin, a swarthy dwarf who had reared him.

When Siegfried attained manhood Regin told him of his parentage, that he was the orphaned son of a fearless king who had died gloriously in battle. "The time has now come," Regin said, "when you must leave the forest and go in search of adventure in the world." Nothing loath, Siegfried prepared to depart, but first he asked that Regin make him a trusty sword. Regin, who was a skilled smith, straightway began to forge a sword for Siegfried, but when he had finished it the youth easily shattered it by striking it on the anvil. Three others met the same fate.

"If I am to do battle," said Siegfried, "I must have a sword worthy of my strength." Thereupon Regin took the broken pieces of the sword which had belonged to Siegfried's father, filed them into steel dust, and from this with all his art he made a wonderful shining blade. This also Siegfried tested by bringing it down with a mighty blow on the anvil. It was not broken, but the anvil was cut in two.

Fafnir, the Terrible Dragon

In the long evenings Regin had told Siegfried of the fearful dragon Fafnir who guarded in his cave a priceless treasure, slaying those who tried to gain it. To the den of the dragon Siegfried now made his way. When Fafnir heard him approaching he roared until the ground trembled. Nothing daunted, Siegfried guarded himself from the maddened rushes of the hideous creature, until with a thrust of his sword he so wounded the dragon that it at last fell dead. Siegfried thus gained the treasure which the monster guarded. By bathing himself in the blood of the slain dragon he became proof against wounds, excepting in one small spot between the shoulders where a linden leaf had fallen. Accidentally tasting the blood, he discovered that he was able to understand the language of the birds and beasts, and by eating the monster's heart he was endowed with even greater strength. According to another story the treasure which Siegfried gained was obtained by slaying the kings of the Nibelungs (*see* Nibelungs, Song of the).

After performing many other great feats Siegfried at last came to the court of Gunther, king of the Burgundians, where he was greeted as a hero, with feasts and all honor. He wedded Kriemhild, sister of Gunther, a maiden of marvelous beauty, and became the most heroic and beloved knight in Gunther's kingdom. But among the king's vassals was one, Hagen by name, who was jealous of Siegfried's glory. By clever lies he induced Gunther to believe that Siegfried would some day steal his power, so the king agreed to help destroy Siegfried.

Knowing that there was but one place in which Siegfried could be wounded, Hagen treacherously played upon Kriemhild's fear for Siegfried's safety on the battlefield, and begged her to tell him of the fatal spot, saying, "I ride close behind your lord in battle, and should the fight wax fierce, knowing his vulnerable spot I might protect him." Kriemhild innocently disclosed the secret, and unknown to Siegfried she sewed a tiny cross between the shoulders of his tunic. The dauntless hero thus became an easy prey to those who sought to slay him. Gunther arranged a hunt, and the cowardly Hagen thrust a spear into the fatal spot, while Siegfried lay drinking from a woodland stream. Mortally wounded, Siegfried attacked Hagen but died before he had avenged himself. The whole kingdom mourned Siegfried's loss, and it is said that even the gods sorrowed and there fell upon the earth a gloom that lasted for many days. This story is the theme of one of the musical dramas of the composer Richard Wagner.

SIERRA (*sĭ-ĕr'ȧ*) **NEVADA.** The loftiest and grandest mountain range in the United States, the Sierra Nevada ("snowy range") forms a great wall 400 miles long and 50 to 80 miles wide, in eastern California. A gap through which the Feather River flows separates it from the Cascade Range on the north. On the south it ends at Tehachapi Pass in Kern County. The rich Sacramento and San Joaquin valleys lie on its western side, their orchards and grainfields irrigated by the waters of its snow-fed streams. The eastern base springs from the deserts of the Great Basin, which is deprived of rain-bearing winds from the Pacific by this great rampart.

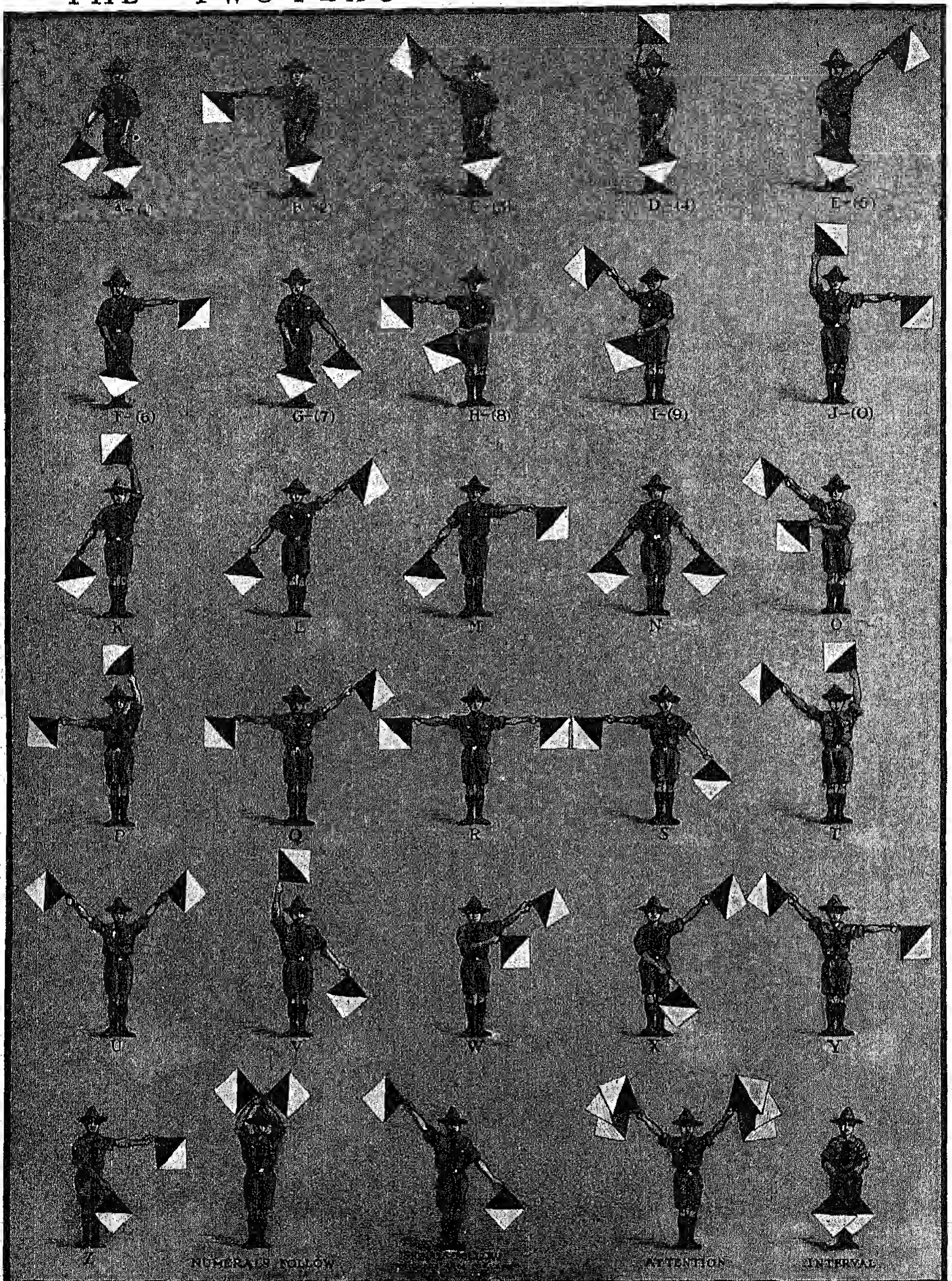
Along the jagged, snowy crest line 12 peaks rise more than 14,000 feet above sea level. Mount Whitney is the highest peak in the United States proper (14,495 feet).

The range is a giant block which was uplifted along its eastern edge and tilted to the west. The east side plunges abruptly to the plains 5,000 to 10,000 feet below. High on its rugged face, in a basin due to fracturing and slipping of the rock, lies beautiful Lake Tahoe. The longer, gentler west slope is scored with deep canyons and valleys carved by glaciers and rushing streams. The most famous is the Yosemite (*see* Yosemite Valley), but the canyons of the Tuolumne, Kern, and Kings rivers are also notable. Dense forests mantle the western slopes to a height of 9,000 feet. Here are the giant sequoias, the largest trees in the world (*see* Sequoia). Three national parks preserve the glorious scenery of these mountains—Yosemite, Kings Canyon, and Sequoia (*see* National Parks). The range was named by the Spanish settlers after the Sierra Nevada in southern Spain, the highest mountain range in that country.

SIGNALING. Even the most primitive of peoples have always had systems of signaling by which they could transmit information over long distances. For short distances the early signals were chiefly gestures or signs with the hands or body. For longer distances, especially in warfare, beacon lights, such as fires and torches, were used, as well as smoke columns, the display of shields, spears, banners, etc. Who has not pictured on the background of romance the beacon fires by which the Indians, signaling from one mountain peak to another, summoned their councils?

These early methods seem crude indeed in comparison with the modern telephone and telegraph.

THE "TWO-FLAG" SEMAPHORE SIGNALS



Here are the positions you would use in sending a message by means of two hand-flags. You will notice that the first ten designate both letters and numerals. The rule is that these positions usually designate letters; but if you give the "numerals follow" signal each subsequent position means a numeral, until you give an "interval." Then each position means a letter. The method is exceedingly rapid and is not very difficult to learn.

But even today various signal systems are in use and are of the greatest importance, especially at sea, in military operations, on railroads, and in weather bureau activities.

Signals Used at Sea

At sea, signaling is an important phase of navigation. Most nations use the International Signal Code, comprising an alphabet of flags in variously colored designs, and a code pennant, used also for answering. This code is translated into the languages of the maritime nations, so that sailors of any tongue may read the message fluttering from the signal bridge. When the flag colors cannot be seen (they are visible for only about three miles), cones, balls, and drums may be placed in vertical arrangements, or a fixed "semaphore"—a post to which two mechanical arms are attached—may be operated.

Before the telegraph was invented, the semaphore was extensively employed to transmit dispatches. Codes for spelling out messages were devised, in which different positions of the signal arms stood for different letters. Operators observed distant semaphores through telescopes. Today the semaphore is used chiefly for signaling on railroads.

The United States Navy has a signaling system based upon its own code books for private reports between ships. These books contain most of the usual messages, and signals need indicate only book and message number. This system has a flag for each letter and each numeral, and several special flags—annulling flags, convoy flags, position pennants, etc. Hauling down the ensign indicates the completion of a signal. One of the commonest systems for short-distance signaling is the "two-flag semaphore," in which a sailor, perhaps standing aloft on a signal bridge, waves a square flag in each hand. The positions of the flags indicate the letters of the alphabet. In the "wigwag" system, now almost discarded because it is so slow, the International Morse Code is used, with a movement of a single flag or lantern to the right for a dot, and to the left for a dash.

Flashing Lights at Night

At night, lights replace flags. Red, green, or white stars are shot from a Very pistol; and searchlights or smaller flashing light systems transmit the dots and dashes of the International Morse Code. A searchlight beam turned upon the clouds may be seen by ships many miles below the horizon.

The navy employs radio for long distance or rapid dispatching between ships. Radio is priceless regardless of distance in foggy or stormy weather. Life at sea has become much safer through radio communication, and the use of radio compasses, radio beacons, and radio depth indicators. Weather reports and storm warnings are regularly broadcast to ships and airplanes. (*See* Radio.) Famous among the many instances in which radio has saved lives at sea is the "S O S" signal—three dots, three dashes, three dots—of the sinking *Titanic* on April 15, 1912. The call brought the steamer *Carpathia* speeding over miles of water in time to rescue more than 700 of the *Titanic's* passengers. (*See* Icebergs.)

In fogs and storms, signals are sent out at regular intervals from lightships and shore stations by radio, bells, horns, sirens, or whistles. (*See* Lighthouses and Lightships.) Submarine signals, including those made by strokes of a bell or impulses from an oscillator immersed far enough to be free from wave disturbances, are picked up by microphones attached to the bows of the ship well below the water line. The microphones are electrically connected to the pilothouse and other convenient operating positions on board. Such signals are used to indicate the presence of shoals, harbor entrances, near-by ships, and the like.

Signaling in the Army

Signaling in the United States Army is chiefly a responsibility of a special branch, the Signal Corps, organized in 1860. The principal means of communication are wire and radio telegraphy and telephony; messengers, such as motorcycle dispatch carriers and runners; homing pigeons; and visual signals, such as fireworks and signal lamps. Signaling from aircraft to ground is done by radio, dropped messages, homing pigeons, such fireworks as the Very pistol, and by prearranged meanings of certain movements of a plane in flight. Signaling from ground to airplane is done by radio, fireworks, searchlights, picked-up messages, or by rectangular strips of white cloth, usually three, which, when displayed in various combinations, indicate code messages.

The International Morse Code is used by the Signal Corps for both wire and radio telegraphy and for lamp signaling. In time of war all radio messages, and most messages sent by wire, are 'cryptographed"; that is, they are sent in a secret cipher or a code, so that a message cannot be understood until it has been deciphered with the aid of a key.

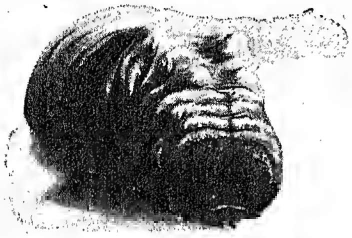
Boy Scouts use the International Morse Code with one flag, the two-flag or semaphore code, or the Indian sign language, a method of hand signaling (*see* Boy Scouts).

SILICON. This element might well be called "the earth maker," for the earth's crust consists largely of silicon compounds, such as the oxide of silicon, called silica (SiO_2), and the silicates of aluminum, magnesium, iron, and other metals. Quartz and most sand, granite, and many other rocks are silica formations; while clays and soils usually contain silicates. Plentiful as it is, silicon never occurs free in nature, but when extracted from its compounds appears as a grayish substance with non-metallic qualities.

Silicon enters into the composition of many semiprecious stones, including agate, amethyst, aventurine, bloodstone, cairngorm, carnelian, cat's-eye, chalcedony, chrysoprase, jasper, mocha stone or moss agate, onyx, opal, rose quartz, and sardonyx. Natural compounds of silicon play an important part in industrial chemistry and in the manufacture of glass, earthenware, furnace linings, and other heat-resisting materials.

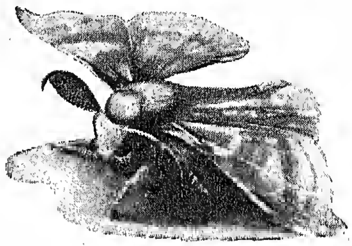
When united with equal parts of carbon in the intense heat of an electric furnace, silicon yields the artificial substance carborundum (SiC), which is near to the diamond in hardness, and is widely used for whetstones, grinding wheels, and polishing and abrading powders. It was obtained by accident in 1891 by E. G. Acheson, an American, while trying to make artificial diamonds. He named the material. It is so resistant to heat that a coating of carborundum and fire clay one-twelfth of an inch thick is said to be able to protect the brick lining of a furnace against any heat ordinarily used, even in melting iron and steel. Carborundum is made at Niagara Falls, by fusing a mixture of 34 parts of coke, 54 of sand, 10 of sawdust, and 2 of salt for 36 hours in an electric furnace.

Pure silicon may be obtained by chemical processes either as a non-crystalline brown powder or a crystalline gray one. Silica united with hydrogen and oxygen in the form H_4SiO_4 constitutes silicic acid. Silicon steel is of great value to the electrical industry because of its magnetic properties. (*See* Alloys.)



Silk Worm

THE LITTLE SPINNER *and* *Its Dress of Silk*



Silk Moth

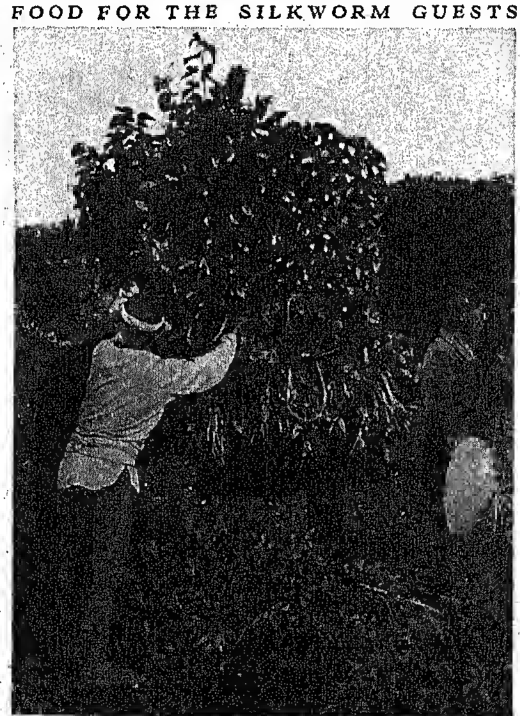
SILK. Once upon a time a dainty little empress sat in her garden watching the sun shining down on her mulberry trees, while the fountains bubbled with laughter and the wind brought to her the fragrance of the spring. This empress lived more than 4,500 years ago, the story goes, in Hang-Chow-Foo, the "City of Heaven," which was the old southern capital of China, and her name was Si-Ling-Shi. Presently she saw a caterpillar on one of the branches making for himself a beautiful little house with threads spun from his body.

All day long the empress watched the caterpillar. She saw that from the under side of his head flowed a shining thread, which he wrapped around and around his body until he was all enclosed in a delicate little cocoon which looked as if it had come from fairyland.

"But the whole beautiful thing is just one long thread, wound as if on a distaff!" cried the empress. "If I could only unwind it, what an exquisite fabric it would make! Why couldn't I? I believe I could, for there is not one little tangle in it. It just needs patience."

So she coaxed the emperor to give her a grove of the choicest mulberry trees. And there she worked, carefully gathering the tiny eggs of the silkworm moths, and when they were hatched picking with her own hands the tenderest leaves for the baby worms to eat, until the time came when they, too, had spun their exquisite cocoons And one happy day she succeeded in twisting together the strands from a number of the little silk balls into many long threads. Hundreds of yards she wound off, and from them she wove a wondrous shimmering fabric more beautiful than any that had ever been seen before. To this day it is called "si" in China, "soie" in France, and "silk" in English-speaking lands, in honor of clever Si-Ling-Shi.

FOOD FOR THE SILKWORM GUESTS



After Lady Moth has laid her eggs and after these eggs have turned into the little worms that spin the silk, comes the busy time of the gatherers of mulberry leaves. These Japanese are gathering a load for the voracious babies, who eat their own weight in mulberry leaves every day of their lives!

All over China the culture of the silkworms spread, and when the empress died the southern part of the empire was a bower of mulberry trees, and Hang-Chow-Foo was famous for its beautiful silks and embroideries. The empress was placed among the Chinese deities as the "Goddess of the Silkworms," and every year when the mulberry leaves open there is a feast day in her honor.

While this is only a legend, it bears witness to the fact that silk culture was known in China from a very early time. For more than 2,000 years the

Chinese manufactured silk and sold it to their neighbors in Japan, India, and Persia. But the secret of how it was made was faithfully kept by the Chinese, though it was known to hundreds of millions of the vast empire's population.

When Alexander the Great swept with his victorious Greeks through Asia into India, about 330 B.C., he carried back with him to the Mediterranean lands the first raw silk that Europe had ever seen. But he did not get the most important thing of all, the secret of the silkworms, which remained locked in the strange old walled country of China until 300 years after the Christian era. Then it was carried to Japan by four Chinese maidens, kidnapped by the Japanese from a silk-weaving village. At about the same time a Chinese princess, who had married an Indian prince, is said to have carried silkworm eggs hidden in her headdress to her new home, and taught her new subjects this valuable art.

But the knowledge of silkworm culture spread very slowly, and as late as 550 A.D. all the silk in the Roman Empire was brought by caravan over dangerous overland routes from Persia and India, which made it so expensive that it was an extravagance even for emperors. Not until Justinian's reign (527–565) were the first silkworms brought to Constantinople. Two Persian monks who had lived in China were induced by the emperor to go back to that land and try to procure some of the silkworm eggs. If their purpose had been discovered they would certainly have been killed, but they returned safely with the precious eggs concealed in their hollow pilgrim's staffs, and from those eggs were produced the silkworms which supplied the western world for 1,200 years.

The new industry spread slowly from Constantinople. Under the conquering Saracens it was carried both east and west. Sicily became one of the homes of silk cultivation and manufacture, and the art spread next to Florence, Milan, Venice, and Genoa, all of which became famous for their beautiful fabrics. Silk manufacture began in France as early as the 13th century, but the production of cocoons was not successfully begun until the close of the 15th. About the same time England began to manufacture fabrics from imported silk skeins, but all attempts to breed silkworms there have failed. After 1685, when the Edict of Nantes was revoked, 400,000 Huguenots, many of whom were especially skilled in weaving silk, fled from France to England, Switzerland, and Germany, and gave tremendous impetus to the growth of the industry in these countries.

AFTER THE SPINNING IS DONE

These little spinners have finished their spinning and the silk dresses they have made for themselves will soon be converted into dresses for other people. The upper picture shows a group of silkworm cocoons in their nests on branches of brushwood laid in racks like those of the picture below. The Japanese girls are removing finished cocoons.

All attempts to introduce silkworm culture into the United States have failed, although far more silk is manufactured and used here than in any other country. About 1838 a variety of mulberry tree, which was said to be adapted to culture in the United States was extensively introduced, but growers soon found that the trees were not hardy enough to withstand the northern climate, and a fatal blight in 1844 completed the downfall of the industry. (*See* Mulberry.)

It is now realized that the culture of raw silk can be profitably undertaken only where there is an abundant supply of cheap labor, since the care of the worms and the preparation of the raw silk requires much patient attention. Today raw silk is produced in considerable quantities only in China, Japan, India, France, Italy, Persia, and Turkey. Bengal is one of the ideal silk-raising districts of the world, for the climate there permits of three crops of cocoons a year—one in March, one in July, and one in November. Some of the other countries have two crops, others only one.

THE REELING OF THE SILK

After the cocoons have been gathered and the young worms have been killed by dry heat or steam, they are sorted according to color, size, and quality. Then the delicate threads from several cocoons are unwound and laid together so as to make a single strand and these strands are wound on reels. In the small communities of Japan, reeling is done as you see it here, but silk reeled in this way is apt to be uneven and lumpy. The best silk is reeled in large factories by machinery.

Though Asiatic countries grow the bulk of the world's silk, they manufacture little more than they use themselves. The western nations, with their improved machinery, are able to manufacture more cheaply. The silk goods industry in the United States is comparatively young, having grown up since the Civil War. This country now imports about 75 per cent of the world's production of raw silk. The leading manufacturing centers are in New Jersey (especially Paterson), Pennsylvania, New York, and Connecticut. In Europe the most important manufacturing countries are France, Germany, Italy, Switzerland, and Great Britain. The workers are usually women, and in Pennsylvania and some other states they are often the wives and daughters of workers in the coal mines.

The wonderful little silkworm that makes all the world's silk is hatched from a tiny egg about the size of a pin's head. In the early summer the mother moth lays from 200 to 500 of these eggs on strips of paper or muslin prepared for her. They are kept in a cool dark place, and in the spring are put into trays and hatched by artificial heat. When the young worms or larvae emerge from the eggs they are little dark wriggling creatures about a quarter of an inch long. They have prodigious appetites, and soon they are eating their own weight in mulberry leaves every day. They grow so fat that they shed their skins four times before they are full grown. It takes about a ton of leaves to raise from 30,000 to 35,000 of the worms.

OPENING A BALE OF SILK

The reels of silk are shipped in bales with matting covers. This bale is being opened at a silk mill at South Manchester, Connecticut.

In four to six weeks the worms have become plump, grayish-white caterpillars, about $2\frac{1}{2}$ inches long, and they are ready to spin their cocoons. They then climb up the brushwood branches or the many-celled racks prepared for them, and begin the work for which they

have been so carefully reared. On both sides of their bodies are glands which have become filled with thick gluelike material. The worms now press this out in two slender threads which stick together as they emerge from an opening in the upper lip, called the "spinneret." The fluid threads at once harden in the air into the tough silk fiber, and the larvae weave them into cocoons completely surrounding their bodies, by bending their heads forward and backward in a figure-eight loop, presenting a most comical aspect at the task. In three or four days the cocoons are completed. In shape and size they are somewhat like pigeons' eggs and each contains from 500 to 1,200 yards of continuous thread.

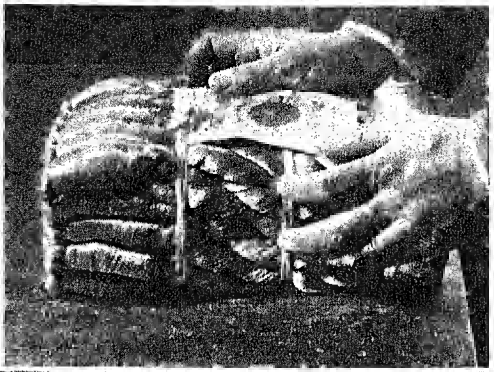
The cocoons made by domesticated silkworms in the Orient are usually white or light yellow, but nearly all the cocoons woven in western countries are yellow. In some parts of the Far East the cocoons of other insects akin to the silkworm are used, but the fiber from them is not so good as that of the domesticated silkworm. The commonest and best of these "wild silks" is called *tussur* silk because it comes from the tussur worm. Familiar examples of fabrics made from wild silks are pongee, rajah, and shantung. The color of wild silk is usually ecru or pale green, and it cannot be removed by boiling as can the color of domestic silk. So the wild silks will take only the darker dyes.

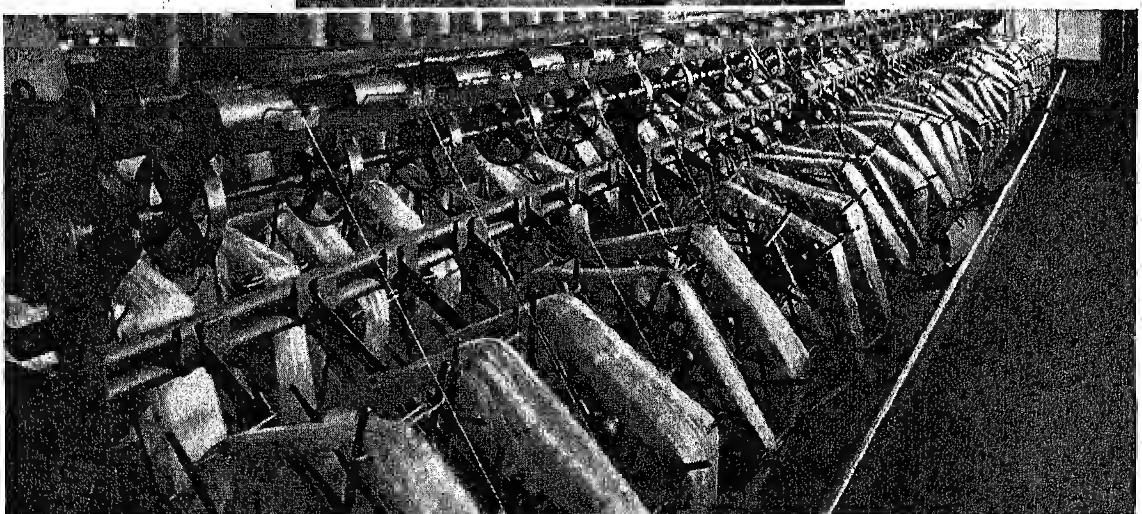
Sorting the Cocoons

Two or three days after the cocoons are completed they are gathered and sorted. A few of the best are put aside in a warm place and carefully guarded until the developed moths bore their way out, to lay eggs for next season's brood of worms. The rest of the cocoons are put in a hot oven, or exposed to the sun's rays under glass, to kill off the worms within before they start breaking out of the cocoons and ruin the silk.

The next step is the exceedingly delicate and

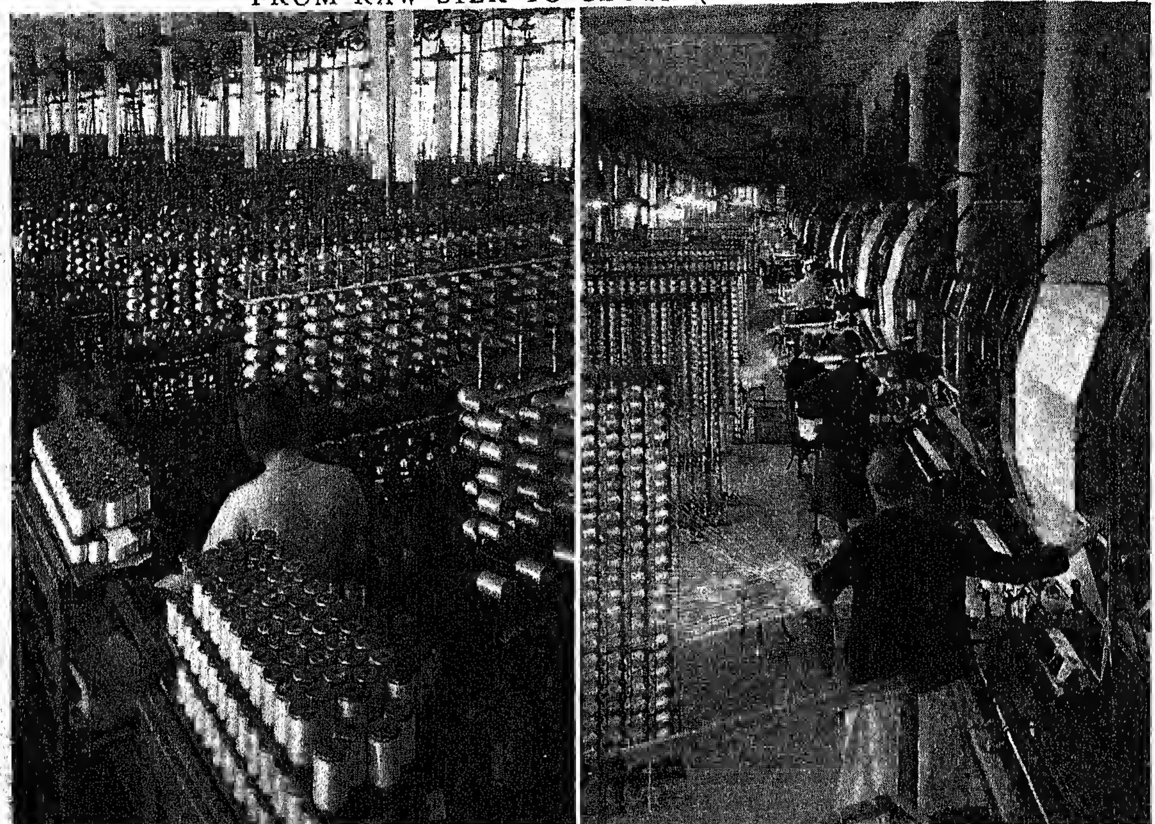
FROM RAW SILK TO CLOTH





At the top is a "book" of raw silk just as it comes from the bale. It contains 30 skeins and weighs 4½ pounds. The second picture shows the skeins about to be soaked in warm soap suds to loosen the natural gum which makes the threads stick together. After soaking, the skeins are straightened out and dried. Then they are put on reels called "swifts," as shown in the bottom picture, and the long threads are wound off the reels and on to long spools or bobbins. Succeeding steps are shown on the following page.

FROM RAW SILK TO CLOTH (CONTINUED)



After the raw silk is wound on bobbins, the strands from several bobbins are combined and twisted into a single strong thread, as shown at the left. This may then be "doubled" on itself and twisted again in a reverse direction to make a still stronger thread. The entire process is called "silk throwing." At the right, the completed threads from scores of spools are being drawn off to form webs of parallel strands upon the big warp frames. These will go to the loom for the weaving of the cloth as shown on the next page.

laborious process of removing the fiber from the cocoons. First they are soaked for a few minutes in hot water to soften the gummy coat, while a girl constantly stirs them with twigs. The outside of the cocoons is a coarse covering of loose fibers, which adheres to the twigs and is so removed. Then the cocoons are put into trays filled with warm water, and the ends of several of the long threads are brought together and passed through a tiny guide like the eye of a needle. The fibers stick together to form a single strand and are wound upon a reel.

When the reel is full, the silk is taken off in large skeins, and this is the form in which most raw silk reaches the United States. It takes from 130 to 140 pounds of cocoons to yield 12 pounds of raw silk, and the fastest workers can reel only a pound or two a day.

In many places the reeling is done by machinery, which not only increases the speed but also produces more even threads.

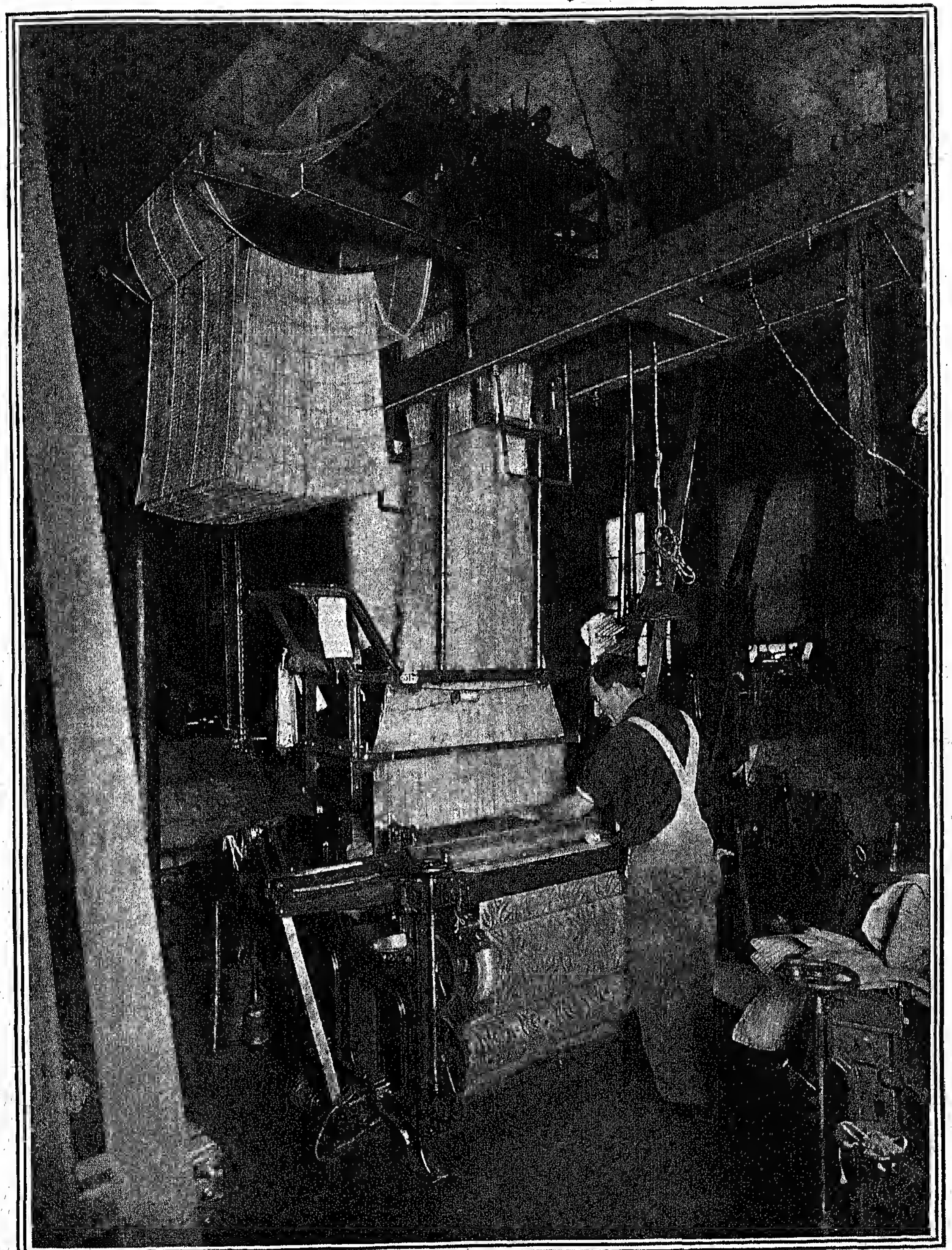
Before the silk is ready to be woven on the loom, it must be soaked to loosen the natural gum that makes the threads cling together, and it must be put back on reels so it can be wound off upon bobbins. Then comes the process known as "throwing." In this operation threads from several bobbins are twisted and doubled into a more substantial yarn, while any thick lumps or imperfections are removed. One pound of good quality raw silk will yield enough unspun thread to reach from Philadelphia to New York and back—a distance of 181 miles. "Tram" silk, used for the woof in weaving, consists of two or more threads twisted together. To make "organzine," which is used for the warp of heavy fabrics, the threads are double-twisted. This is done on machines which twist the threads about 16 turns to the inch in one direction, then double it and twist it about 14 turns the other way. To convert a single pound of raw silk into organzine requires 264,000,000 revolutions of a spindle, so it is easy to understand why the throwing is not done in the Asiatic countries where the machinery is crude.

Silk Dresses That Are Half Tin!

For most purposes the yarn must now be steamed or boiled in soapy water to remove what remains of its natural gummy coating and other impurities. This does not affect the length or strength of the filaments, but it reduces the weight of the silk by about one-fifth.

The next process takes advantage of the fact that silk has an astonishing capacity for adding to its weight by absorbing and retaining various substances.

WEAVING SILK FABRIC ON JACQUARD LOOM



Figured fabrics are woven on a Jacquard loom. Those strings from above lift the warp. Each of the strings is attached by a hook to the griff overhead. Each hook is controlled by a needle, which presses against those perforated cards (upper left) as they pass over a cylinder. The needles entering the perforations keep their hooks attached to the griff so that it raises the corresponding warp threads. But the needles intercepted by the card disengage their hooks, and their warp threads remain unlifted. Thus the design of fabrics, like the one shown, is determined by the perforations of the cards.

Either before or during the dyeing process, most silks are put through a bath of tin, iron, or zinc solution. The silk absorbs the metal, gaining in weight from 20 to 100 per cent, or even more. Some silk fabrics are thus more than half metal. "Weighted" silks have a better luster than unweighted silks and also have better draping qualities, though they are usually less durable.

After the silk has gone through these processes, and has been bleached (if for white fabrics) or dyed (if for colored fabrics), it is ready for weaving (*see* Spinning and Weaving). Waste silk, that is the "floss" silk from the outside of the cocoons, and the large proportion—about three-tenths—of the inside of the cocoons that cannot be unwound, is treated much like wool, and is spun into threads called "spun" silk. This is used for silk yarns and for making fabrics of less durability than true silk.

Almost one-half the silk manufactured in the United States is used for dress goods. A garment of pure silk lasts a very long time, for there is hardly any material that wears better. The silk from worms fed on the ailanthus tree wears better than from the worms fed on the mulberry tree, but it is not so soft and glossy. Silk velvets, ribbons, hose, silk fringe, embroidery and sewing silks, upholstery materials, and even the tough fabric of balloons and parachutes, are among the important products of the silk industry.

There are a variety of silk weaves. The most common ones are: *plain*, china, taffeta, foulard; *rib*, bengaline, poplin, grosgrain, faille, rep, moiré; *twill*, silk serges, twilled foulard; *satin*, broad silks; *gauze*, grenadine, marquisette; *double cloth*, ribbons, neckties; *pile*, velvet, plush; *fancy* and *figured*, brocades, damasks, brochés; *lappet*, embroidered figures on plain or gauze fabrics.

An artificial silk called "rayon," made from the cellulose of wood or cotton linters, has replaced real silk for many purposes (*see* Rayon).

Laundering and Care of Silk

Silk is easily ruined by improper laundering. Hot water, a hot iron, or hot sunshine, yellows silk. The water and iron should be of medium heat. Mild soap should be used, as strong soap yellows the silk and destroys the gloss. The soap should be dissolved, never rubbed directly on the material. Silk should never be rubbed or twisted, but should be squeezed gently, and the rinse water should be of the same temperature as the suds. The silk should be rolled in a cloth while wet and left until dry enough to iron. It is best to dry delicate fabrics by twisting them in a heavy towel. Silks should be ironed on the wrong side, or covered with a thin cloth if it is necessary to iron on the right side. Soiled spots attract moths, so all grease and dirt should be removed before putting silk garments away.

Scientific name of silkworm moth, *Bombyx mori*. It belongs to the *Bombycidae* family of the moths. The body is about half an inch long, and the outspread wings measure about two inches from tip to tip. The domesticated silkworm has been so weakened by the artificial life to which it has been subjected that it has been robbed of its natural strength and has become subject to many serious diseases. Hundreds of bacteriologists are kept busy studying the microbes that prey upon this little animal and seeking means to combat them.

SILOS. Storing green crops in a silo is like bottling up a pasture for use during the winter months or for use all the year around to take the place of pasture land partly or entirely. Nearly every well-equipped farm has one or more of these tall cylindrical structures in which to store up fresh juicy foods for the stock, much as fresh fruits and vegetables are canned for human use. Dried grains and fodder unmixed with green foods are not only expensive for feeding stock, but are so unsatisfactory for milch cows that it was common practice to allow them to go dry during the winter months. The ensilage or silage, as the contents of the silo is called, rivals the pastures of June in providing the succulent foods so necessary for the dairy herd, as well as other farm stock, and it is especially useful in promoting the healthy growth of young animals.

Corn, which is the principal silage crop, is cut before the juices of the green plants begin to dry out in the fall. The entire plant—stalk, leaves, and ears—is chopped into short lengths by machinery so that it will pack readily, and put directly into the silo. If the corn is too dry, water is poured over it as it is packed away. It is estimated that food equivalent to four tons of hay can be produced ordinarily from one acre of corn. This makes corn preserved in a silo a very economical crop, especially as it is so compactly and economically stored. Clover, oats, rye, sorghum, alfalfa, cow peas, beans, millets, and wheat may also be used as silage when cut green. Recent experiments with sunflowers for silage have been very successful, the yield being twice that of corn. Green material closely packed in an air-tight silo will keep in good condition for many months. Although some chemical changes take place, the composition and feeding value of silage is practically the same as that of the green plants.

The silo, which has brought about some of the most important changes in modern agriculture, was introduced into America from Europe about 1875. The first silos were pits dug in the ground into which the crops were packed and covered over with straw and sod. The modern silo is above ground and is built of wood, brick, stone, or concrete. Concrete is favored in most localities because it is durable, airtight, water-proof, and vermin-proof. Practically all silos are built in cylindrical form, leaving no corners where air spaces may cause the spoiling of the silage. They are made tall with small surface area so that the silage may be used from the top fast enough to keep the surface from spoiling.

SILVER. Late in the spring of 1859 two grizzled miners were busy with pickax and shovel in the barren wilderness near where Virginia City, Nev., stands today. They were digging a reservoir to collect water for their crude mining operations. For months

THE ART OF THE SILVERSMITH

These pictures tell the story of that silver cup at the bottom. The figure on the cover is cast in the mold the masked workmen are pulling from the furnace. The rest is modeled by hand. First a silver sheet is fixed around a wooden form or "chuck." This revolves in a lathe while the circular designs are pressed in with steel tools. The embossed portions are tapped out by a steel mallet set vibrating in a vise. The cover rim is hammered *out* by hand, and certain other portions of the design are stamped by a press, or "chased," that is driven in with the blows of a punch. Last of all comes the polishing against a spinning wheel.

the gold dust they had been able to wash from the near-by gravel banks had scarcely provided a living.

At a depth of four feet one of the miners felt his pickax strike a hard substance, a heavy black dirt very different from the surrounding yellowish gravel and clay. Completely ignorant of the nature of the substance, they washed it in their "rockers." They were disappointed to find, instead of fine yellow gold, a much lighter-colored metal, barely tinged with a golden hue. Not long afterward they sold their discovery for a small sum, little realizing that it was one of the richest bodies of silver ore ever unearthed. In 30 years the little strip of ground, known as the Comstock Lode for one of its discoverers, produced more than 300 million dollars' worth of silver and gold. This tremendous production cheapened silver and upset the money standards of the whole world.

Age-old History and Modern Production

Silver has been known and used by man since prehistoric times. It is mentioned in the Chinese classics, dating from 2500 B.C. Herodotus, the Greek historian, says: "So far as we know the Lydians were the first to make coins of gold and silver." The silver mines of Laurium, in Attica, are famous in Greek history; and those which Carthage exploited later in Spain are even better known. Roman envy of this wealth helped bring on the Punic Wars.

Since the discovery of America in 1492, about 15 billion ounces of silver have been mined throughout the world. This is 15 times the production of gold in the same period. The Americas have produced 85 per cent of the total, and North America alone has produced 60 per cent. Mexico is far in the lead, with the United States and Canada next in order. In the United States the greatest output has come from Idaho, Utah, Montana, Nevada, Colorado, and Arizona. (*See* Mines and Mining.)

Monetary and Industrial Uses

About three-fourths of the world's production of silver is used for monetary purposes, either as coins or as bullion which governments hold to redeem paper currency. Many oriental countries, most notably China and India, use silver as a standard of monetary value (*see* Money).

The leading industrial use is for the manufacture of tableware and jewelry. The photographic industry is the second largest industrial consumer. Compounded with bromine or chlorine, silver forms the salts which register light and shade on films, plates, and photographic prints (*see* Photography).

Silver is an important substitute for copper, nickel, aluminum, and tin when these cheaper metals are unavailable. It can replace tin in common solders; a standard formula is 95 per cent lead or cadmium and 5 per cent silver. It can replace copper in certain parts of electrical equipment. Silver-plated bearings in airplanes and other machines surpass all other types for satisfactory service.

Because silver is highly resistant to organic acids and alkalies, many items of chemical and food-manufacturing equipment are silver lined. *Silver nitrate* or "lunar caustic," made by dissolving the metal in nitric acid, is a powerful antiseptic. It is used to treat eye and throat infections and for certain gastric and intestinal diseases. As a bactericide it is used to sterilize drinking water and swimming pools, and in certain mouth washes, soaps, and salves. Silver nitrate is also used for making mirrors (*see* Mirrors). *Silver fulminate*, made by adding alcohol to a solution of silver nitrate in nitric acid, is a dangerously sensitive explosive.

"Sterling" and Other Standards of Fineness

Pure silver is too soft to stand constant wear; hence for most uses it is alloyed with some other metal. Silversmiths use silver .999 fine—that is, 999 parts of silver to one of another metal. This fineness is also used for monetary reserves; but United States silver coins contain only 90 per cent silver, alloyed with 10 per cent copper.

Sterling silver, used in jewelry and tableware, is 92.5 per cent silver and 7.5 per cent copper. Plated silverware is a coating of silver electroplated on a base metal such as nickel silver, britannia metal, copper, or brass (*see* Electricity; Electroplating).

Chemical and Physical Properties

Silver is a lustrous white metal, widely distributed in nature. In ores it is commonly associated with gold, lead, and copper, and much of our silver is obtained as a by-product of smelting these other metals. It is one of the chemical elements; its chemical symbol Ag is from the Latin "argentum" for silver (*see* Chemistry).

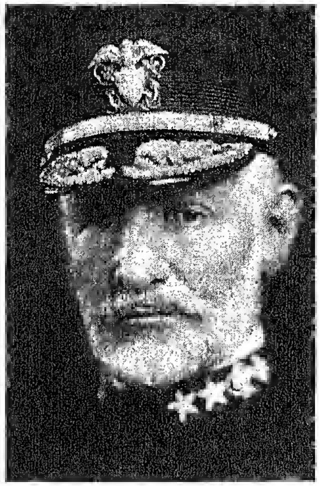
Silver is second only to gold for malleability and ductility. Silver leaf can be beaten to a thickness of 1/100,000 of an inch and one ounce can be drawn out into a wire 30 miles long. As a conductor of heat and electricity, silver is superior to all other metals. It melts at 1,761° F., and boils at 3,542° F. At this temperature it volatilizes, or forms a pale blue vapor which can absorb 20 times its volume of oxygen. As the vapor cools to a solid, it expels the oxygen with great violence—a phenomenon known as "spitting silver." It resists corrosion, but combines readily with sulphur. The black tarnish on silverware is silver sulphide, which is commonly formed by the sulphur in eggs.

The Silver Purchase Acts

The "New Deal" Silver Purchase Acts of 1934 and 1939 authorized the Treasury to buy silver until one-fourth of the value of the combined silver and gold monetary stock was represented by silver, or until the world market price reached \$1.29. But the market price never reached this figure; and since the government was buying gold freely at this time the 25-75 ratio of silver to gold was never realized. By paying far above the normal market price the Treasury accumulated an enormous horde of almost 3 billion ounces, or one-fifth of the world's production since Columbus discovered America, in its vaults at West Point, N. Y.

In 1943 Congress authorized the Treasury to meet some war demands for silver by loaning "free silver," that is, bullion not required as security for outstanding silver certificates. It could be used only for such purposes as would not result in its destruction.

SIMS, REAR ADMIRAL WILLIAM SOWDEN (1858–1936). Few officers of the United States Navy have had as stormy a career as this fearless, outspoken fighter. He created more than one international incident, was publicly reprimanded by a president, and several times barely escaped court-martial. Yet when the United States went to war with Germany in 1917, it was Rear Admiral Sims who was chosen to command American naval operations in European waters.


ADMIRAL SIMS

He was born of American parents at Port Hope, Canada, Oct. 15, 1858. During his boyhood the family moved to Pennsylvania. He was educated at the Naval Academy at Annapolis (1876–80). Fame first came to him in 1902, when as a young lieutenant on duty in China he went over the heads of his superiors and sent directly to President Theodore Roosevelt the charge that American naval gunnery was hopelessly inaccurate. President Roosevelt called him home and placed him in full charge of target practise. He spent seven years at it, but he succeeded so well that he became known as "the man who taught the navy how to shoot."

In 1910, while delivering a speech in London, Sims (then a commander) declared: "If the time ever comes when the British Empire is seriously menaced by an external enemy, it is my opinion that you may count upon every man, every dollar, and every drop of blood of your kindred across the sea." For this speech he was sharply and formally reprimanded by President Taft. But in April 1917 Sims, then president of the Naval War College at Newport, was placed in charge of American naval forces in Europe. He remained at this post until the end of the war.

In 1922 Sims was retired with the rank of rear admiral. He remained a vigorous critic of naval policies.

SINGAPORE (*sĭng-gȧ-pōr′*). Merely a pin point on the map, Singapore, the island city off the tip of the Malay Peninsula, is the key to the vast empires that surround it. It is situated on the Strait of Malacca, where the Indian Ocean meets the Pacific, and it thus dominates the channel for trade between the West and the East. Even in earliest times it was a center of commerce; in modern times it became also Great Britain's most important military and naval outpost in the Far East.

The island was acquired by Britain from the Sultan of Johore in 1819. At that time, after centuries of neglect, it was virtually an uninhabited swampland. Under British rule it soon became a great modern port, but it was not until 1922 that work was begun to fortify the island on a vast scale. Four square miles of jungle at the northern end were cleared and made into one of the strongest naval bases in the world. A huge floating dry dock, made in England and towed all the way to Singapore, and another dock constructed on the island, could each accommodate vessels of more than 50,000 tons. Here also were immense facilities for storage of supplies, two great air bases, and powerful coastal defenses. During the second World War, the Japanese fought their way through the swamps and jungle of the Malayan mainland to storm the island fortress from the rear. On Feb. 15, 1942, Singapore surrendered and its vast advantages fell to Japan. (*See also* Malay Peninsula.)

In normal times the harbor on Singapore Strait was filled with an amazing assortment of vessels—ocean liners, Malay proas, and queer Chinese junks. Eastbound ships halted at Singapore on their way to China, the East Indies, and Japan; westbound ships, on their way to India, Africa, and Europe. Billions of dollars of commerce every year passed through this harbor, the great clearinghouse for the trade of southeastern Asia.

Behind the busy water front lies the town of Singapore, a tropical city ablaze with heat (seldom below 70° F.) and oriental color. It is one of the most picturesquely cosmopolitan cities in all the world, for although three-fourths of the people are Chinese, there is scarcely a color, creed, or nationality unrepresented in the narrow swarming streets of the native quarter.

Singapore island is 26 miles long and 14 wide, with an area of 220 square miles. Most of it is covered with the luxuriant green foliage of a hot, wet climate. Rain falls, on the average, on 173 days of the year. The island lies in a region rich in rubber and tin, and these are the chief exports. The town of Singapore was the seat of government for the Straits Settlements, a British crown colony. Population of island, more than 565,000; of town, more than 445,000.

SIPHON. If you wish to demonstrate the principle of the siphon, fill a rubber tube with water, pinch the two ends to keep the water in, and put one end in a bucket of water on the table and the other in an empty bucket on the floor below. Release the ends and the water flows up through the tube from the upper bucket and down into the one on the floor.

Gravity is pulling down on the water in both limbs of the tube; yet it flows up one side and down the other. Why? Atmospheric pressure does the trick—atmospheric pressure plus the difference in the weight of the two columns of water in the tube. When the water flows out of the lower end, atmospheric pressure on the water in the upper pail pushes it up to fill the vacuum that would otherwise occur at the top of the bend. The siphon will not raise water more than about 33 feet, because then the weight of the water equals the atmospheric pressure. The so-called "siphons" of charged water are not true siphons, for the water is forced out by the pressure of the gas.

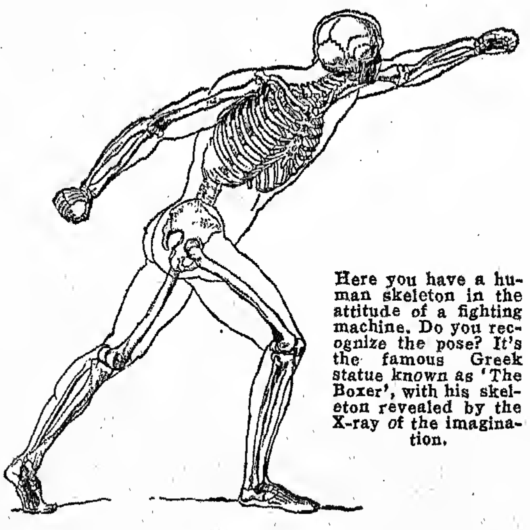
SISAL (*sī′säl*). Binder twine, cord, and some rope are made from the fibrous leaves of two species of the agave plant. Both species are commonly called sisal. One is the true sisal (*Agave sisalana*), and the other is henequen (*Agave fourcroydes*), also called Mexican or Yucatan sisal. Both originated in the Yucatan peninsula. They are cultivated on large plantations in the tropics. East Africa, Java, and Sumatra are the principal sources of true sisal today. Yucatan still produces most of the world's supply of henequen, which is somewhat inferior in quality to sisal.

Sisal and henequen, like their relative the century plant (*see* Agave), bloom only once and die after flowering. The plants normally mature in from five to ten years, but their life may be prolonged by cutting a certain proportion of the leaves each year. The swordlike leaves are from 30 to 60 inches long and 4 or 5 inches wide, ending in a sharp spine. They spring up straight and stiff from a central bud.

The leaves are cut by hand, one at a time, and the terminal spine and marginal prickles trimmed off. One man, with an assistant to trim and bundle, can cut from 3,000 to 5,000 leaves in a day. Plantation railways transport the bundles directly to a central mill, where machines beat and scrape the pulp from the fiber. The fibers are then dried in the sun or in drying machines, and are sorted into grades according to length and quality. As fibers for making cordage, sisal and henequen rank next to Manila hemp in strength. The name "sisal" comes from the Yucatan port from which this fiber was formerly shipped.

SISYPHUS (*sĭs′ĭ-fŭs*). In the dark underworld of Tartarus Sisyphus pushes a rock up a steep hill. Just before the rock reaches the top it plunges back again, and so his wearying task is never ended. Sisyphus was the mythical king of Corinth, called the "most crafty of men." He was condemned to eternal punishment because, according to Greek legend, he had outwitted even Death with his trickery. Dante, in his great poem the 'Inferno', and Homer, in the 'Odyssey', describe the labors of Sisyphus.

THE MARVELOUS FRAMEWORK OF THE BODY



Here you have a human skeleton in the attitude of a fighting machine. Do you recognize the pose? It's the famous Greek statue known as 'The Boxer', with his skeleton revealed by the X-ray of the imagination.

SKATES AND RAYS. On the bottom of the sea, in shallow coastal waters, live the skates and rays. Their broad, flat bodies are well adapted for this mode of life, and their coloration, blending with the sea floor, keeps them from being noticed by their enemies. The wide, flattened pectoral fins, attached to the body and head, give the fish its peculiar triangular, diamond, or disk shape. In general, the skates are thick-tailed, the rays whip-tailed.

Skates and rays are naturally sluggish, but in pursuit of food they move rapidly by flapping their broad fins. They seize their prey—small fish and crustaceans—by pouncing on top and folding their bodies over the victim. In most species the mouth is a narrow slit on the under side of the head. The breathing mechanism is nicely adapted to life on the ocean floor. When the fish is resting on the bottom, it cannot inhale through the gills on the under side of the head without getting sand in the delicate filaments. It therefore inhales through two spiracles, or breathing holes, on the top of the head, and exhales only through the gills. When in motion it breathes in the usual manner through the gills.

Skates and rays lay their eggs in oblong leathery cases, with a streamer at each corner. The cases are known as mermaids' purses.

The skates and rays range in size from the common skate, 18 inches long, to the manta or devil-fish, measuring 20 to 25 feet wide and weighing over half a ton. On the Atlantic coast of North America the best-known species of skates are the common or little skate, and the larger barndoor, winter, or peck-nosed skate, four or five feet long. On the Pacific coast are the common and big skates of California.

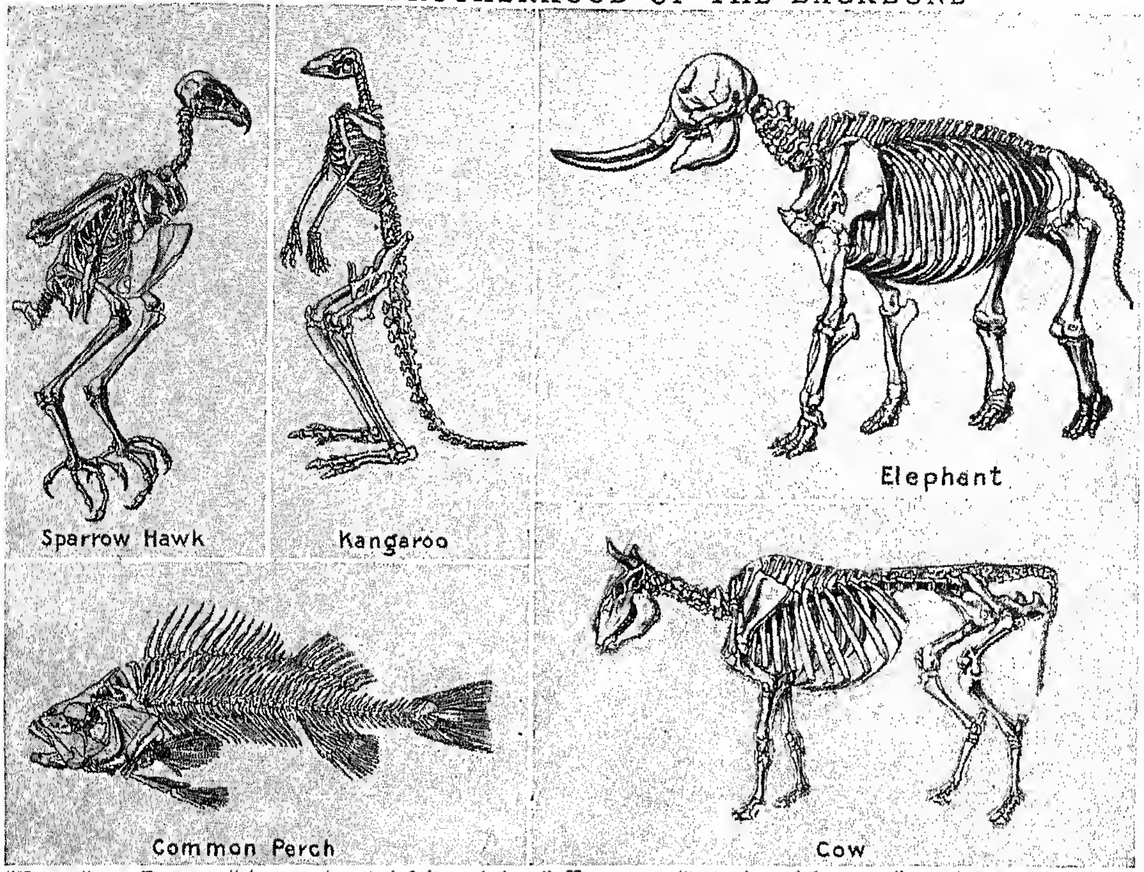
The sting-rays have long, slender tails armed with poisonous barbs, and can inflict dangerous wounds. These rays are common in the warm waters off the Florida, California, and Gulf coasts, and from the West Indies to Brazil. The eagle rays range from Cape Cod to Brazil and from northern California to Panama. The largest of all the rays is the manta, also called the devil-fish, devil-ray, and sea-devil. It frequents warm waters and differs from the majority of the rays in living more in the open sea.

Scientific name of common or little skate, *Raja erinacea;* barndoor, winter, or peck-nosed skate, *R. laevis;* common skate of California, *R. inornata;* big skate of California, *R. binoculata;* sting-rays, family *Dasyatidae;* eagle rays, family *Aëtobatidae;* manta or devil-fish, family *Mobulidae*.

Skates and rays are closely related to the sharks. Electric rays, or torpedo-fish, and the sawfish are species of rays (*see* Sawfish; Sharks; Torpedo-Fish).

SKEL′ETON. The bones of the body form a framework called the skeleton. This framework supports and protects the softer tissues. All the higher animals have an internal skeleton (*endoskeleton*) with a central spine or backbone. Many lower animals, such as insects and shellfish, carry their skeletons on the outside (*exoskeleton*). Other creatures of very simple construction have no skeleton. The jelly-fish, squid, and octopus, for example, are supported primarily by the water in which they live.

THE GREAT BROTHERHOOD OF THE BACKBONE



"Nature," says Emerson, "plays one tune to infinite variations." Here we see illustrations of the many "tunes" that she has played on the idea of the backbone. To the backbone of the Sparrow Hawk she attached wings and so made a bird of the air. In the picture of the Kangaroo, note the relative size of the front and hind legs. Even if we had never seen a Kangaroo, the skeleton would tell us that it did not walk on all fours. The Elephant and the Cow have a somewhat similar anatomy, since they are both mammals, and a similar cumbrous dragging gait since neither is a hunter. But the Perch might say: "We fish are the grandfathers of them all"; for Nature's great discovery of the backbone was made in the life of the water.

The normal human skeleton is built of 214 bones. Whether as a framework for the attachment of muscles or as a protection for delicate organs, each bone is shaped with exactness and precision. Some bones are knit solidly together, others are loosely connected, each designed to meet its particular needs.

The movable appendages are hung on a central post known as the axial skeleton. This, with the vertebral column for a nucleus, consists of the bones of the head, neck, and trunk.

In infancy the spine is made up of 33 irregular bones called vertebrae. Early in life the nine bones at the lower end of the column are welded into two, the upper five uniting to form the sacrum, and the remaining four the coccyx. So during the greater part of life we have 24 vertebrae (seven cervical, in the neck; 12 thoracic, that carry the ribs; five lumbar, in the region of the loins), one sacrum, and one coccyx.

Each vertebra is constructed like a ring. These rings, piled one upon the other with a padding of cartilage between, are studded with bony projections called processes and serve for the attachment of muscles and for articulation with other bones. The spinal canal, which is the hollow inside the backbone, contains the spinal cord, and between each pair of vertebrae are openings through which the spinal nerves pass.

If our vertebral columns were straight pillars we would be jarred into nervous wrecks. To prevent injury to the spinal cord and brain, nature has built it like a shock absorber with four curves, giving a slight S-shape, that act as springs.

Jointed to the thoracic vertebrae are 12 pairs of ribs, but only the upper seven of these fit into the breastbone in front. Three of the remaining five pairs are attached by cartilage, but the last two are unattached. The breastbone itself, or sternum, situated in the midline of the chest wall, is a flat bone shaped like a blade. Sternum, ribs, and 12 vertebrae make up the framework of the thoracic cavity.

Whatever the length of the neck, it is always composed of the seven cervical vertebrae. The upper two are the atlas and axis. Atlas supports the head and

rotates with it on a pivot-like process (the *odontoid process*) of the axis.

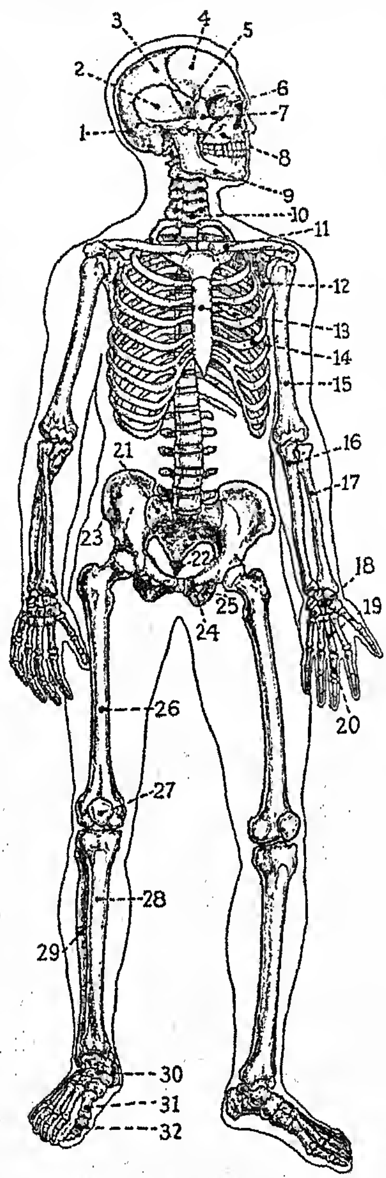
The skull is composed of cranial and facial bones. Eight bones unite to inclose the brain with a strong box or cranium and to form sockets for the eyes and ears. Its back and base is the occipital bone, perforated by the *foramen magnum*, a passage for the spinal cord. Two parietal bones form the roof and the principal part of the sides; below each parietal bone is one of the temporal bones, which contain sockets for the ears, and bear the knoblike cellular parts called the mastoid processes; the frontal bone shapes the forehead; while the sphenoid and ethmoid take part in the formation of the eye sockets, separate the brain from the nose, and form the floor of the cranium case. Besides these bones which make up the cranium box proper, fitted into each of the two temporal bones are three tiny bones—the *malleus* (hammer), *incus* (anvil), and *stapes* (stirrup)—of the middle ear (*see* Ear).

The face requires 14 bones: a lower jawbone known as the inferior maxillary or mandible; two superior maxillaries to build up the upper jaw and part of the roof of the mouth; two nasal bones for the bridge of the nose, and the vomer for its partition; two malar bones for the cheeks; and a pair each of lacrimal, palate, and inferior turbinated to complete the facial structure. Of the joints in the cranium and face, only the lower jawbone is movable. It is joined to the temporal bone by a ball-and-socket joint to allow movement.

To lessen the weight of the skull, some of the bones contain sinuses, or spaces filled with air. The frontal sinus, for example, is in the forehead over the eye cavity. The sinuses communicate with the nose and are lined with mucous membrane. An infection in these cavities is commonly spoken of as "sinus trouble."

Jointed to the axial skeleton are the bones of the upper and lower extremities. These constitute the appendicular skeleton. The arms are supported by a shoulder girdle, which has on each side a clavicle or collar bone, and a scapula or shoulder bone. The humerus is the bone of the upper arm, and the ulna and the radius form the forearm. The hand has eight carpal or wrist bones, five metacarpals which form the palm, and 14 phalanges that make up the fingers.

BONES IN THE SKELETON



The bones numbered above are: 1. Occipital. 2. Temporal. 3. Parietal. 4. Frontal. 5. Sphenoid. 6. Nasal. 7. Malar. 8. Superior maxillary. 9. Inferior maxillary. 10. Vertebrae. 11. Clavicle. 12. Scapula. 13. Sternum. 14. Ribs. 15. Humerus. 16. Ulna. 17. Radius. 18. Carpals. 19. Metacarpals. 20. Phalanges of fingers. 21. Sacrum. 22. Coccyx. 23. Ilium. 24. Pubis. 25. Ischium. 26. Femur. 27. Patella. 28. Tibia. 29. Fibula. 30. Tarsals. 31. Metatarsals. 32. Phalanges of toes.

The bony framework of the lower extremity is built on the same plan as the upper extremity. Each of the two hipbones, *ossa innominata*, is made up of three parts—the ilium, ischium, and pubis. The hipbones unite with the sacrum and coccyx of the vertebral column to form the pelvic girdle, which supports the legs. The femur, the patella, and the tibia with its neighbor, the fibula, form the leg. The ankle for flexibility has seven small tarsal bones; five metatarsal bones form arches that are like powerful steel springs propelling us along as we walk; and the 14 phalanges of the toes add further elasticity and make the act of walking more graceful.

The bones in our bodies are all smoothly jointed and firmly held together by flexible ligaments. The ends of the bones in each typical joint are padded with cartilage, covered with a thin sheath, the synovial membrane, and oiled with a lubricating fluid, so that we can use them constantly and yet they never wear out. In the juncture of two bones the movement permitted varies, therefore joints are classed as immovable, yielding, and those having free motion. Thus the joints of the cranium are immovable; the vertebrae are yielding; and the shoulder joint has free motion. The muscles in large part are attached to the bones across the joints, so that movements are brought about by the shortening or contraction of the muscles.

SKIN. Human skin is composed of two main layers, the "epidermis" or scarf skin outside, and the "dermis" or true skin underneath. The true skin is studded and ridged with tiny projections above; the scarf skin is correspondingly pitted and furrowed underneath; and the two fit together like the parts of a puzzle. On the palms of the hand and the soles of

the feet these ridges become so prominent that the upper surface of the epidermis is ridged and furrowed in patterns of tiny whorls and loops which are unique for each individual, so that each person has distinctive finger-prints (*see* Finger-Prints).

We speak of "thick-skinned" and "thin-skinned" people, but we are all comparatively thin-skinned over certain parts of the body (about 0.5 of a millimeter or $\frac{1}{50}$ of an inch on the eyelids, for instance), and thick-skinned over others (4 millimeters—about $\frac{1}{6}$ of an inch—or more over the palms and soles). The skin is thicker over the back than in front, and on the outer than on the inner sides of limbs.

The outer layers of the epidermis are constantly drying up, flaking off, and being renewed from below. The deeper epidermis layers contain the pigment (*melanin*) that makes an Indian brownish-red, a Chinese yellow, and a Negro black. White skins look pink when they are transparent enough to let the blood show through them. Fingernails and toenails, like the claws and hoofs of the lower animals, and the hollow horns of the ruminants are merely thickened and hardened epidermis. Hair too is modified epidermis (*see* Hair).

Two sets of glands pour their secretions over the skin. The flask-shaped sebaceous glands, situated in the true skin and usually associated with the hairs, occur practically all over the body except on the palms and soles. In health their oily semifluid secretion lubricates the skin and hair. Sometimes it hardens within the duct, forming a plug or "blackhead," which has to be pressed out. The sweat glands are set deeper and reach the surface through crooked ducts, twisted like a corkscrew where the outer epidermis is thick and horny. They are scattered all over the body, being most numerous in the places from which the sebaceous glands are absent, the palms and soles. There are estimated to be nearly 3,000 sweat glands to the square inch in the palms—more than six times as many as in the skin of the back. Their secretion, the perspiration, is essentially water.

The skin serves a threefold purpose: (1) Tough, and elastic, it protects the body tissues against injuries, and is especially thick and cushioned with fat where it is subject to constant pressure, as on the soles. (2) Much news of the outside world reaches us in the form of sensations of touch, heat, and cold through the special sense organs in the skin. Many of the tiny protuberances (called "papillae") on the upper surface of the dermis contain nerve-endings; these "tactile papillae" are especially numerous over the soles and palms. (*See* Touch.) (3) The skin helps to regulate body temperature. It is an insulator that keeps in heat. When extremely cold it warms itself by shivering. When too warm it cools itself through the evaporation of perspiration.

"Goose flesh" or "goose pimples" are caused by the contraction of tiny muscles at the hair roots. The reaction corresponds to the fluffing out of feathers by birds and of hair by furred animals. It takes place in the cold and in moments of excitement—probably a survival of the days when hairy men kept themselves warmer in this way and made themselves look larger to their enemies.

SKUNK. The common skunk is a peaceful little animal. He almost never attacks his neighbors. In return he expects to be let alone, and usually he is. The biting, evil-smelling liquid he can spray from the scent glands under his tail drives off all but the most reckless enemies.

OTHER ANIMALS RESPECT HIM

Skunks usually have black fur, with one or two conspicuous bands of white along their backs. Their tails are tipped with white. They are slow moving and never run from an enemy.

Skunks live in a family den—a hole in the ground or a snug hollow under rocks or fallen trees. Here, about the end of April in a grass nest built by the mother, 4 to 10 young skunks are born. They are the size of field mice. In about eight weeks they are out learning to dig up grubs and to strike down beetles and grasshoppers with their big paws. Later they will catch mice and feast on wasps and bees without seeming to feel their stings.

Days are for sleeping. Nights are for hunting. But sometimes in the late evening skunks play a queer game. The family forms a circle with their noses pointed toward the center. They hop forward until their noses touch. Then they hop backward. Maybe they will do this a dozen times, and then they waddle away for their nightly dinner—always in single file. When winter comes, skunks put on fat and retire to their dens, where they sleep most of the time until spring.

Skunks grow to the size of cats, though their long bushy tails and fluffy fur make them seem bigger. Most farmers like them in the fields because they destroy pests, but many are killed for raiding poultry houses. Trappers catch skunks for their fur, which is sold under the name of "black marten" or "Hudson Bay sable."

When taken young, skunks often make affectionate household pets. Sometimes the scent glands are removed, but since these are used only in extreme fright or anger, the operation is seldom necessary.

Scientific name of common or striped skunk is *Mephitis mephitis*. The smaller spotted skunk of the west and south is *Spilogale putorius*. This is the "hydrophobia skunk" of western legend, a name based on a few experiences with spotted skunks that had been bitten by "mad" coyotes. Skunks are sometimes called "polecats," but this term properly belongs to a European ferret, *Putorius foetidus*.

SLANG. There is a "vagabond language"—wild, free, racy, often vulgar—which refuses to follow the usual standards established by the best writers and speakers. We call it slang.

At its worst the use of slang tends to vulgarize one's speech, to limit one's vocabulary by driving out the more reputable words. It leads one to look for expressions that are in themselves striking or "different," rather than those which convey the exact shade of meaning. The slangy person whose adjectives are limited to "rotten," "punk," "swell," and "stunning" finds himself at a loss when he attempts to describe a thing accurately.

The Spice of the Language

At its best, slang lends spice to language. It is often forcible, vigorous, and picturesque. Slang expressions are sometimes homely but effective figures of speech (*see* Figures of Speech). Most slang expressions are short-lived; but in every age there are some of these vagabond words which are, as it were, admitted into respectable society and become part of the standard language. Had our forefathers never used slang, our language would be much poorer. "Blizzard," "skyscraper," "mob," "humbug," and "banter" were originally slang expressions. "Squelch" was found to be so convenient and expressive a word that it has been admitted into approved usage. So have many other words and phrases, formerly frowned upon, such as "swat," "hold up" (to stop in order to rob), "fill the bill" (to satisfy requirements), "graft" (to obtain public money dishonestly), "bluff" (to deceive by a confident manner), "nice" (in the sense of agreeable or pleasing), and "bogus" (counterfeit).

From its beginnings in the jargon or *argot* of criminals and vagrants or in the special language of various trades and professions, slang has spread to nearly all walks of life. The student talks of "boning" or "bucking" or "cramming" for an "exam." The actor waits to "see the ghost walk" (get his salary). The theatrical manager hopes the play will "register" or "get across" to the public. The writer prays his story will "click." The artist complains that his picture has been "skied" (hung too high in an exhibition). The speculator looks for a "slump in the market" if the "bears" triumph over the "bulls." And the person who always agrees with his boss is called a "yes man" or an "apple polisher."

The Picturesque Slang of War

The first World War stimulated much slang and near slang. "Doughboy," "Tommy," "poilu," and "boche" or "Heinie" or "Fritz" designated American, British, French, and German soldiers, respectively. A "gob" was a "jackie" or enlisted man in the United States Navy. An "ace" was a flier who had brought down five or more enemy planes. To the British soldier, "blighty" meant home; to "go west" meant to die. The United Nations freely exchanged slang in the second World War. The Americans offered "Popeye" (spinach), "boon dockers" (field shoes), "goof off" (to get into trouble), and "sweating out" (reprimand from officer). The British popularized "rhubarb" (opportune target for bomber), "prang" (to crash in airplane), and "brassed off" (bored). The Australians contributed "cobber" (buddy), "dill" (stupid), and "dinkum" (on the up-and-up).

SLATE. School "slates" and the queer slate tombstones of colonial New England belong to a past day. But the dark gray (sometimes blue, greenish, purplish, or even red) stone from which they were made is still widely used for roofing, sinks, washtubs, flooring, blackboards, billiard table tops, mantels, etc. For all these uses slate is especially suitable because of its smooth, easily cleaned surface, and its property of splitting into thin slabs or leaves.

Most slates have been formed, by pressure, from sedimentary rocks first deposited by water as beds of clay. If such clay becomes structureless stone by the mere removal of uncombined water, it is mudstone; if, having been deposited in layers, it has a tendency to split along the bedding planes, it is shale; but if—perhaps having first been tilted up at a new angle—it has then been compressed by tremendous force, so as to spread it out and produce cleavage planes at right angles to the direction of pressure, it becomes slate. This tendency to split into thin slabs is so characteristic of slate that the name is sometimes applied to shale and almost any rock which splits in this manner—as anthracite slates, whet slates, and talc slates.

Slates are widely distributed, but those of good commercial quality are not. Most of the slate used in the United States is quarried in Pennsylvania, Vermont, New York, Maine, Virginia, Maryland, and Georgia. Most European slate comes from Wales and France.

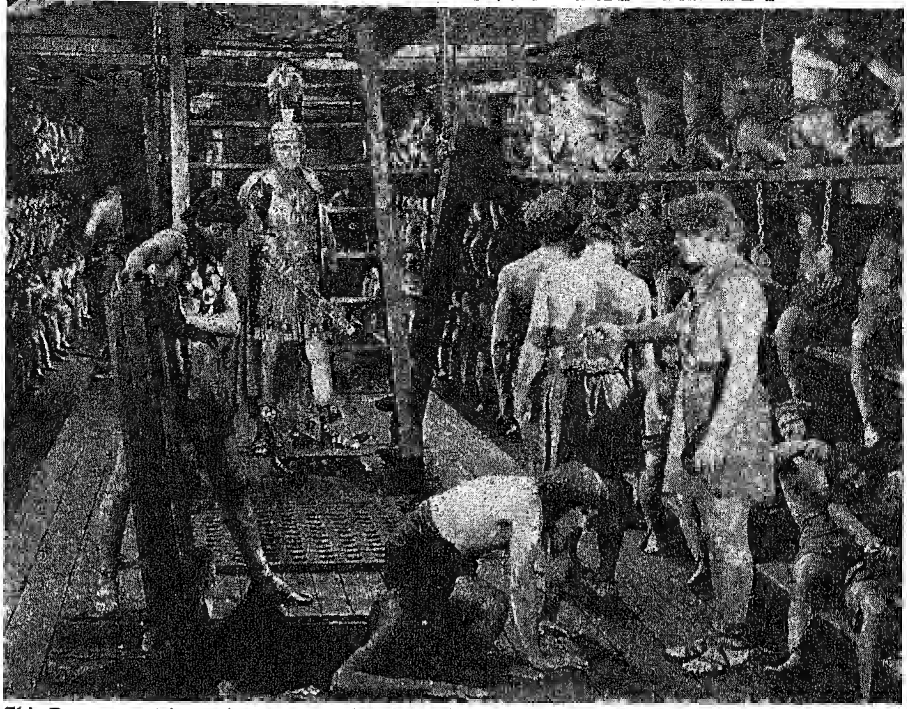
SLAVERY AND SERFDOM. "Man has a back, and he will not work unless it is beaten." So runs an old Egyptian proverb, and in every age of the history of the world there have been men who have taken these words to be true. The earliest laws of Babylonia recognized that one man might own another man, as he owns a sheep or an ox, and do to him very much the same as he does to his sheep or ox; the Bible allowed slavery and nowhere says that it is wrong; Abraham armed "his trained men, born in his house, three hundred and eighteen." Among the Greeks, Aristotle, the greatest mind of the ancient world, said, "The lower sort of mankind are by nature slaves, and it is better for them, as for all inferiors, that they should be under the rule of a master."

In early times men often sold themselves or members of their family to pay a debt or merely to secure money for some end. In Greece and Rome a debtor could be enslaved by his creditor, though this was soon forbidden. The principal cause of slavery in the ancient world was that people of one country looked upon all other peoples as their inferiors, and therefore a conquering nation took not only the land and herds won in war, but the inhabitants as well. The Greek formula for a successful war ran, "They killed the adult males, and sold the women and children into slavery." Julius Caesar once sold 60,000 captives.

Slaves are never found in great numbers among simple pastoral and agricultural peoples. In general, slavery accompanied the accumulation of wealth. A family which found itself able to feed another mouth

soon realized the convenience of having a slave to perform the heavy labor. But it was only in times of great prosperity and in settled societies, when nations had money to invest in large enterprises and when slaves could earn more than they cost, that slavery existed on a great scale. Though such conditions were found at times in Egypt and Babylonia, not nearly so much is known of the life of slaves in those countries as in others of the ancient world.

HOW MAN POWER MOVED THE GALLEY



This Roman war trireme interior, reproduced for the motion picture 'Ben Hur', shows how scores of Roman galley-slaves bent their backs pulling the three banks of oars. Notice the chains and ropes that bound the weary men to their posts, and the dark hold where they sweltered when not on duty.

Slavery in Greece and Rome

There were slaves in Greece and Rome when those peoples were in the pastoral and agricultural stages, but in comparatively few homes and in small numbers. In the Homeric period, to judge from the references in the 'Iliad' and the 'Odyssey', slavery seems to have been well established. Early in the historic period, about the 5th or 4th centuries B.C., Athens was a center of industry, with thriving workshops in such numbers that there was more work than the Athenians could do. Slaves were brought in large numbers, principally from Thrace, but many came from Syria, Egypt, and other Asiatic countries. Native Greeks were also enslaved, sometimes sold as children by parents who could not or would not support them, sometimes seized by pirates and sold, but more often taken prisoners in war and held by their conquerors.

The conditions of these slaves in Greece, particularly the industrial slaves in Athens, were strikingly good, for the Athenians recognized that, if the slaves were to be efficient workers and produce articles of beauty and high craftsmanship which would sell in competition with the products of other cities, they must be willing laborers. The hope of freedom was held before them; they could save a little out of their earnings or their food, "cheating their stomach," as the Romans quaintly expressed it, lay by tips and presents, and ultimately purchase their freedom. One of the wealthiest bankers in Athens came there a slave, purchased his freedom, and was finally made a full citizen because of his benefactions to the city. A famous cook amassed enough money in two years to buy three small tenements. The slaves dressed like the other residents of the city, and the complaint was often heard that they refused to make way on the sidewalks before Athenian citizens.

In Rome slave labor was used to an extent never seen before or since. The hundreds of thousands of captives taken in her endless series of wars, and the enormous wealth which the aristocracy accumulated from these wars, made slavery the very foundation of the state. Many functions which today are carried on by free labor, except those of the higher offices of government, were performed by slaves. They were the physicians, teachers, governesses, house servants and farm hands, the actors on the stage, the acrobats and jugglers of the amphitheaters, the charioteers of the circus. They kept the books of the business man, carried on his correspondence, and had charge of much of the management of his affairs. In the service of the state they were the oarsmen of the fleet and, for a time, the marines as well. The great public works, such as aqueducts, docks, roads, and temples, were the work of their hands. The books in the public and private libraries of Rome were all copied by hand by groups of slaves sitting about a room following the dictation of one of their number who read the text to them from a single manuscript.

The gladiators who fought to amuse the crowds were captives in war who had been purchased by some wealthy Roman. They were trained in gladiatorial schools in the use of various kinds of weapons, and then rented to the emperor or private citizens

who were going to give an exhibition open to the public. Gladiators were in such demand that the owner of a band of trained performers could sometimes get back his entire original investment from one such contract. (*See* Gladiator.)

Some Celebrated Freedmen

Though never given the free movement in Rome which they enjoyed in Athens, the Roman slaves could still save money and in the end purchase their freedom. Scores of thousands of them were liberated by their masters and could ultimately become full Roman citizens. Though some social stigma still clung to such a "freedman," as he was called, it usually disappeared in the second generation, and all civil disabilities were removed in the third generation, which enjoyed full citizenship. The great poet Horace, who gained the favor of Augustus and moved in the court circle of Rome, was the son of a freedman. Terence, Phaedrus, and many other Roman authors were themselves freedmen.

Far different from the lot of the slaves in industry and in the cities was that of their fellows on the great Italian and Sicilian plantations, and in the mines of Greece and Rome. In the fields they frequently worked in chains, and at night were bound together and shut into great prisons, half buried under the ground. The life in the mines beggars description. The famous silver mines of Laurium near Athens have galleries not larger than three feet square. Since these galleries were totally dark, the miners worked with clay lamps set in niches; these lamps could burn about ten hours, which was the length of the shift. The slaves worked in chains, almost naked, and branded with the mark of their owner. The life of such laborers was short, but the profit for their owner was large; so large, indeed, that one Greek writer seriously suggested that the city of Athens purchase 10,000 slaves and let them out for labor in the mines, since the state could in this way realize 33 per cent on its investment.

Early Protests Against Slavery

From the earliest times there was always protest among the Greeks and Romans against slavery. Homer saw the evil effect upon the slave himself: "For Zeus takes away the half of a man's virtue, when the day of slavery comes upon him." When the Greeks considered introducing gladiatorial combats into their games, the gentle philosopher Demonax bade them first cast down their altars to Pity. Other men saw that it drove down the wages of the free worker, that it brutalized the owner, and that it tended to make labor with the hands disgraceful. But few persons advocated its abolition, because they did not see how society could do without it. The slave was an animated tool; a gang of slaves was a machine with men for parts.

Slavery died out when the whole ancient world came to form one state, the Roman Empire. This was partly because the supply of slaves from war was cut off, but primarily because Roman wealth disappeared during the barbarian invasions, and the industrial life of Greece and Rome was displaced by the primitive agricultural society of the Middle Ages.

The number of the slaves in Greece and Rome has been greatly exaggerated. They never constituted more than one-half the population of the state of Athens, and probably not more than one-fourth of the population of the city of Rome. For Italy as a whole the proportion would be very much smaller. The brilliant civilization of Greece and Rome was not "based upon slave labor," as is so often said. The arts flourished because, in Athens and in the better factories of Rome, the slave was scarcely distinguishable from the free man, and because at the side of every slave there was at least one free laborer. Slavery did do one good thing: it gave some men leisure from deadening manual labor, so that they could devote their time to higher things. It did for the ancient world what machinery does for us today.

Serfdom Succeeds Slavery

In Europe slavery gradually disappeared after the 4th century and was rarely heard of by the end of the 10th century. In its place appeared serfdom (*see* Feudalism). The worker was no more the "chattel," or "thing," of his master; but he must render his lord a fixed portion of his services. Serfdom, like slavery, is nearly as old as man. The Egyptian pharaoh was in theory the owner of all the land of Egypt, the peasants owed him a part of their labor, and it was by the hands of these Egyptian serfs that the pyramids were built. The Persians did not enslave or move from their homes the peoples whom they conquered. They preferred to leave them as "royal peasants," as they were called, on the land, requiring them to render tribute to their conquerors in the form of money, products of the field and herd, and labor. The Greeks and Romans took over this institution with but little modification; something like it was to be found among the primitive Germans; and the Roman and German customs blended to produce the serfdom of the Middle Ages.

The serf, like the free peasant, held a few acres of the lord's land, but, unlike the free peasant, he could not move about at will. He was "bound to the soil," and when the land was sold, he went with it. If he fled from the estate, he could be brought back unless he could hide himself "for a year and a day" in some free city. His children also must remain on the land; he could not give his daughter in marriage nor have his son "tonsured" (allow him to become a priest) without the permission of the owner of the land. An old document gives the following list of the services owed by an English serf: For a definite number of days each year he had to harrow the land, carry manure, mow the meadow and gather the hay, haul in the harvest in the fall, bring wood to the manor house, and transport the crops to the nearest market. Besides these services he owed his master four shillings each year, and a cock and two hens at Christmas.

Serfdom was an integral part of feudalism, and there was little difference in principle between the serf who

owed his master the labor of his hands and the powerful vassal who owed his feudal lord the service of his arms in war. But serfdom lived on in many countries long after feudalism had passed away. In England it ceased soon after the end of the great Peasant Revolt in 1381; in certain parts of France it did not disappear until the thrilling night of Aug. 4, 1789, of the French Revolution, when the nobles renounced all their feudal rights. In Prussia it persisted until 1811, and it was not until 1861 that the czar Alexander II, by imperial decree, liberated the 40,000,000 serfs of Russia who had been increasing in number since 1700.

The Revival of Slavery

Slavery revived in the 15th century when Europeans first came into close and continued contact with the African negro. The negroes were people of another color and race, on a lower level of culture, so different from the inhabitants of Europe that they seemed scarcely human. They were the "sons of Ham" of the Bible, ordained to be "the hewers of wood and drawers of water" for the sons of Shem and Japheth. It was the Portuguese who, as they pushed down the west African coast in the 15th century, were the first to introduce into Europe the African slave. Portuguese ships carried slaves to Spain, and after the New World was discovered, descendants of these Spanish slaves were brought to Haiti to work the mines. At first the Spaniards tried to use the local Indians in the mines and on the plantations, but they were not adapted to such labor and were nearly exterminated. But the negroes could endure that toil; and soon the slave ship with its "cargoes of despair," called by Milton

> That fatal, that perfidious bark,
> Built i' the eclipse, and rigged with curses dark,

was a regular sight on the ocean routes between Africa and the New World. The great ship companies of Europe bid against one another for the fortune which lay in this slave trade. By the Treaty of Utrecht (1713), England secured the sole right to supply negro slaves to the Spanish colonies, and in 1739, when Spain tried to revoke the agreement, England went to war to keep it. The demand for slave labor soon passed from the West Indies into North America, and became so great that it is estimated that between 1680 and 1786 more than 2,000,000 slaves were brought into the West Indies and the English colonies.

The First Nation to Abolish the Slave Trade

But as the true nature of this revolting traffic in human beings came to the knowledge of Europeans generally, it outraged the sense of justice of every thinking man. The Quakers had long protested against the trade, and their propaganda against it finally bore fruit. In the famous case of the negro Somerset, the decision was handed down in 1772 by the courts of England that as soon as a negro slave set foot upon the British Isles he became a free man. In 1776 the motion was made in the English House of Commons that "the slave trade was contrary to the laws of God and the rights of men." This motion did not pass, but the end was near. To Denmark belongs the honor of being the first Western nation to abolish the slave trade, in 1792; that example was followed by England in 1807, and the United States in 1808. Further progress was made at the Congress of Vienna in November 1814. Largely through the influence of England, the powers assembled agreed that the slave trade should be abolished as soon as possible, but left the actual date to negotiation among the various governments. The Webster-Ashburton Treaty in 1842, obligating Great Britain and the United States each to keep a naval squadron on the African coast to prevent shipment of slaves, may be taken as the date when organized African slave trading finally ended although for a time cargoes were run illegally.

The Abolition of Slavery by Law

It was well enough to stop the traffic in slaves, but what of the millions of slaves still in bondage and handing down this servile condition to their children? The leader in the agitation against slavery in England was William Wilberforce, who devoted the larger part of his life to denouncing it over the country and introducing measures in the House of Commons for its abolition. In 1833, a month after his death, a bill was passed emancipating the slaves in all British colonies and appropriating a sum of nearly $100,000,000 to compensate the owners for the loss sustained. The same step had been taken earlier by smaller states, but Great Britain was the first great nation to make the institution of slavery illegal. Her example was followed by other states. In the United States the slaves were freed only after a long, costly, and bloody war (*see* Civil War and Reconstruction).

Slavery Lives On

After the American Civil War most people thought that slavery was at an end; but recent inquiries by the League of Nations show that it survives even today. The Mohammedan religion recognizes the institution of slavery, though it commands the master to feed and clothe his slaves as he does himself, and encourages manumission as an act of piety; but the Koranic injunctions are not always observed.

Mohammedan traders in "black ivory" have for years found a sale for their captives in the slave markets of northern Africa and in the Arabian ports along the Red Sea and as far north as Turkey. There are today perhaps 3,000,000 human beings who are living under conditions which amount to slavery, chiefly in Ethiopia, Afghanistan, Arabia, northern Africa, and China. Under the system known as "peonage," in parts of South America laborers become involved in debt which they can never repay and so are no better than slaves for life.

In 1924 a committee was appointed by the League of Nations to investigate slavery and conditions similar to it, such as all forms of debt slavery, the enslaving of children under the guise of adoption, the acquisition of girls by purchase disguised as payment of dowry, and the like. Out of the report of this committee came the Slavery Convention of Geneva in 1926, by which the signatory states undertook to sup-

press the slave trade and to bring about, "progressively and as soon as possible," the complete abolition of slavery in all its forms. In 1933 the League appointed an Advisory Council of Experts on Slavery to gather facts and study the problems of countries in which slavery still exists. The publicity given to their findings aroused several governments to take active steps to end the slave trade.

SLAVS (*slävz*). The Slavic peoples bear a numerical relation to the Teutonic, Latin, and Celtic peoples somewhat like that which the huge solid bulk of Eastern Europe bears to the fringed and attenuated lands of the West. Estimates of the total number of the Slavs vary from 140,000,000 to 172,000,000, and the recent inroads of war, famine, and disease make all reckoning uncertain. Yet the Slavs far outnumber any other European racial division, as judged by the language test, without counting their emigrated members in Asia and America.

The Slavs are a generally broad-headed (brachycephalic) race, sometimes fair, though never so fair as the typical blond Teuton, and sometimes dark. The type, however, has been blurred by many racial crossings. Their name has been derived by an oft-disputed etymology, from a root meaning "glory," which appears in many Slavic names (for instance, Ekaterinoslav, "glory of Catherine"); and it is said—and likewise disputed—that our word "slave" comes from the many Slavic captives once sold in the slave-markets of Europe by their conquerors.

When the Slavs first emerged from obscurity, in the early centuries of the Christian era, their tribes were found northeast of the Carpathians, between the Oder and the Dnieper rivers. They were members of the great Aryan or Indo-European family of peoples and their nearest relatives are the Baltic Prussians, Lithuanians, and Letts. From this original center, they spread in all directions—pushed back on the north and west by Baltic and Teutonic tribes, overrun by successive invasions from Asia, and churned by migration and conflict into many separate nationalities. Some of these groups—as the Wends, Slovaks, Slovenians, Bohemians (Czechs), Moravians, Croatians, Bosniaks, and Dalmatians—while preserving a certain degree of individuality as peoples, became all but effaced politically through conquest, dynastic marriages, or voluntary acceptance of foreign rulers. The Poles, the most individualist and masterful of all the Slavic nations, declined in power through their turbulent and undisciplined aristocracy, and were dismembered in three great partitions at the close of the 18th century (*see* Poland). The vast empire of Russia, formed about the grand duchy of Muscovy, became one of the "six great powers" of the times just past. It included the Great Russians, Little Russians (Ukrainians or Ruthenians), White Russians, and the chief block of the submerged Poles. The Ukrainians probably diverge least from the primitive Slav type. Serbia, Bulgaria, and Montenegro had to battle for existence against the Turks since the 14th century; while Montenegro successfully resisted Ottoman conquest, the two former obtained their independence of the Turks only in the 19th century.

The eastern Slavs of Russia and, in the main, the southern Slavs of the Balkan peninsula, adhere to the Greek Catholic (Orthodox) church, and use the Cyrillic alphabet, a modified form of the Greek alphabet. The western Slavs—the Croats, Poles, and Bohemians, especially—were christianized from Rome and still adhere to the Roman Catholic church and use the Latin alphabet.

The Slavic peoples are only beginning to realize their possibilities industrially and politically, and to play a part in European history in keeping with their numbers. Through the centuries they have been held back by their lack of unity. The eastern and western Slavs, divided by religion, exhausted much of their energy in fighting each other. The geographic position of the Slavic nations was also unfavorable, for it made them the great breakwater of Europe against Asiatic conquest. Successive waves of Avars, Huns, Magyars, Mongols, Tatars, and Turks again and again submerged the beginnings of Slavic culture, and receding left pools of alien population to muddy the Slavic streams by which they were absorbed.

Slavic Contributions to the Fine Arts

The Slavs have won world renown for excellence in the fine arts, notably literature and music. Gogol, Tolstoy, Turgenief, and other Russian novelists of the 19th century are widely read today (*see* Russian Literature). Their fire and vitality have inspired writers the world over. Many modern English novelists were largely influenced by the Russians (*see* Novel). Of great importance, too, is the work of the Polish novelists, Sienkiewicz and Reymont, winners of the Nobel prize.

Chekhof (Russian), Čapek (Czech), and other Slavic playwrights have given power and directness to the drama. Helena Modjeska (Polish) is ranked with the supreme tragic actresses of all time. (*See* Drama.)

The Slavs have enriched beyond measure the world's store of fine music. Poland has given us the piano compositions of Chopin and their interpretations by Paderewski. Russia has given us the work of Tschaikovsky and Moussorgsky; and Bohemia, the compositions of Dvořák and Smetana. (*See also* Music.)

SLEEP. "Where was I when I was asleep, Mother?" This is the question little Robert asked his mother. "Why, right here in bed," she replied, "I watched you all the time."

This answer was true enough; but it did not entirely satisfy Robert, for he wanted to know what happened to him when he was asleep, and why he knew nothing and remembered nothing, and why the time seemed so short during the long hours of the night.

During the day of play and work Robert got tired. He used up the substances of his body faster than they could be repaired. This was true not only for his muscles by which all his movements were carried on, but also for his brain which directed his motions and

received all the time the impressions which came from his eyes, ears, and other sense organs. The brain especially needed to be repaired, for without it all the rest of the body would be of little account. So the thinking machine stopped work. That is sleep.

The brain is a great switchboard by which nerve impulses are shunted in proper relation and the results of many of them stored up to form the basis of memory (*see* Brain). In sleep many of these connections are less close. Impulses cannot pass so readily. Thus the whole structure gets a chance to rest.

What Dreams are Made Of

A strong sensory impulse may still be able to break in and set the machine going. For example, a loud noise or a strong shake may wake one up. If a person eats too much of the wrong food, especially for supper, he has indigestion; and the nerves from the stomach may be stimulated and send strong impulses to the brain. Under such circumstances Robert's sleep is likely to be poor, and he may have bad dreams.

Dreams are due to the fact that certain regions of the brain are not resting. Impulses are passing in partial areas, just as one might imagine part of the central telephone exchange of a great city to be active, while most of it was shut down. Under such circumstances the intelligent distribution and understanding of news would be interfered with.

So it is in dreams. There are no actual sensations for comparison. "Common sense" is off duty. The memory connections are made in an irregular manner. Usually there are no open pathways to the muscles for accomplishing motions. The result is that dreams are unreal and often deal with impossibilities. They are like our imaginings and ideas when awake, except that they are not kept in order.

Sometimes in some persons the nerve switches to the muscles are open in sleep. Such people (whom we call "somnambulists" or "sleep-walkers") may walk or do other things in their sleep and afterward know nothing about it, because the knowing part of their brain was disconnected.

Thus you see the brain may be more or less active. It may act in parts. So also sleep may be more or less sound. It is soundest for the first hour or two. After that the soundness rapidly decreases. This can be determined by finding out how loud a noise is necessary to wake a person at various periods of sleep.

The Machinery Keeps Working

While the big brain, the *cerebrum*, is largely out of commission in sleep, many of the automatic subordinate centers continue active. Respiration goes on, though more slowly. The heart beats more slowly. Many reflexes are active. A person who is asleep will pull away his foot when it is tickled. He knows nothing about it, for the knowing part is off duty.

You might say that this is like a city where the main telephone system is discontinued at night, but the wires for the police and fire houses are still open. The body attends to the absolutely necessary things in sleep; but most of its activities are suspended.

One might think that during sleep when the brain is being repaired it would need more blood. But that is not so. Every organ needs most blood when it is in action; that is, when processes of combustion are going on and a large amount of oxygen must be supplied. The brain is no exception. During sleep it receives little blood. We say it is "anemic." One of the earliest signs of waking is the appearance of more blood in the brain. People in other conditions than sleep may become unconscious from too little blood in the brain, as in fainting.

As a result of these facts some scientists believe that the withdrawal of blood from the brain is the cause of sleep. Others think the anemia of the brain is a result, rather than the cause, of sleep. At present we have to say that the fundamental change that brings on sleep is not understood.

Most adults need about eight hours of sleep in twenty-four. Children need more. Coffee, tea, and some other drinks contain the drug caffein, which in many people produces sleeplessness. These drinks, therefore, should be used sparingly before bedtime.

SLIDE RULE. Engineers and others having much calculating to do often use an instrument called the slide rule, or "slip stick." This employs logarithms, which are explained in the article on Powers and Roots. This tells how adding the "logarithms" of two numbers gives you the logarithm of their product, while division is done by subtracting logarithms. These facts are used in constructing the slide rule.

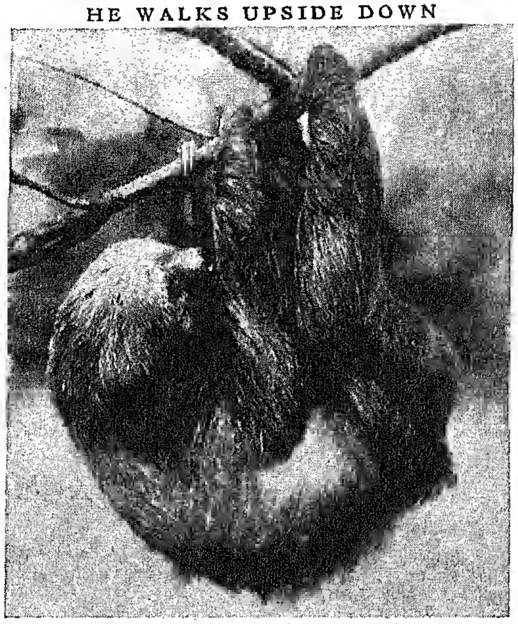
As usually constructed, the slide rule looks like a ruler, except that it has a sliding scale along its center, with fixed scales adjoining. Surrounding this assembly is a transparent slider with a hair-line, to aid in reading crosswise from scale to scale. Each scale is marked with numbers from 1 to 100, with divisions between; but instead of being spaced evenly the numbers are spaced according to the values of their logarithms. The interval between 1 and 2, for example, on one scale is equal to the interval between 10 and 20 on the other.

Suppose now we want to multiply 5 and 3. We place the figure 1 of the sliding scale opposite 5 of the fixed scale. Now, opposite 3 on the sliding scale will be 15 of the fixed scale, this being our answer. Other calculations are performed similarly.

SLIME MOLDS. Sometimes you will find a slimy yellow or orange mass, from the size of a pinhead to that of a man's hand, in forests upon black soil, fallen leaves, or decaying logs. These perplexing forms, called "slime molds," do not seem to be related to any group of plants and have raised the question as to whether they are to be regarded as plants or animals. The ordinary body is a mass of naked protoplasm, called the *plasmodium*, suggesting the term "slime." This body slips along like a gigantic amoeba. In certain conditions these slimy bodies come to rest and organize elaborate and often very beautiful spore-cases. Botanists call the slime molds *Myxomycetes;* zoölogists call them *Mycetozoa.*

SLOTH. These curious animals derived their name from the fact that they usually appear lazy and sluggish in movement, though at times they show considerable agility. Sloths live in trees in the forests of Central and South America; they are indeed the most strictly tree-inhabiting of all quadrupeds. By means of their hooklike claws they cling to the branches with their backs downward, and so appear upside down. They rarely descend to the ground, and crawl on it with difficulty. Their food consists of leaves, young shoots, and fruit. They are silent inoffensive animals and move about mostly at night.

HE WALKS UPSIDE DOWN



The Sloth never, if he can avoid it, walks upright upon the ground. Even in his sleep he hangs upside down.

There are two sub-families of sloths—the *ai*, or the three-toed sloth; and the *unau*, or two-toed sloth. Both are covered with long coarse hair, the shafts of which are roughened or fluted. This hair is naturally grayish, but in the damp forest it is covered with a growth of algae, imparting a peculiar greenish color which makes the animal difficult to distinguish among the foliage. In dry climates the algae disappear and the hair resumes its natural color.

Scientific name of three-toed sloth, *Bradypus tridactylus;* of two-toed sloth, *Choloepus hoffmanni.*

SMELL. The most remarkable fact about our sense of smell is the excessively small amount of substance needed to stimulate the nerve endings in the nasal passages. Some substances can be detected if as little as one thirty-billionth part by weight is present in a given weight of air. Many animals have a far keener sense of smell than man. Just imagine how infinitesimal must be the traces left which enable a bloodhound to follow a criminal many hours after he has escaped! Every dog can recognize his master by the odor, which shows that every human being must have a different odor, though it is ordinarily so faint as to be imperceptible to our own sense of smell.

In primitive men, just as in animals, smell was probably of importance in locating food and avoiding enemies. If you wish to know how different people would be if their sense of smell were as acute as that of the dog, read the story by Mark Twain entitled "A Double Barreled Detective Story."

Smell is closely related to taste, each sense being aroused by chemical substances coming in contact with the nerve endings. In the case of smell the substance must be in the form of a gas. Gases diffuse through the air, consequently we can recognize things at a distance by their odor. The endings or receptors for smell cover a very limited area in the upper part of the nasal cavities. They are so arranged that the air is drawn over them when we breathe.

Many foods have a distinct odor, and the gaseous particles reach the smell receptors when we eat. Hence we confuse taste and smell. The so-called taste of fruits, wine, etc., is really an aroma or smell. Test this by holding your nose and chewing some dry coffee. You will not "taste" anything, but the instant you take a breath the so-called "taste" of coffee will become apparent. This explains why food does not "taste" right when you have a cold. Your sense of smell is lost by the partial stoppage of the nasal passages.

The many kinds of smells have been divided into nine classes. But the actual number of fundamental odors or kinds of olfactory endings is not definitely known.

Smells are intimately related to the emotions. Hence the division of odors into agreeable and disagreeable is probably fundamental and forms the basis on which many animals take their food and know their enemies, mates, etc. Among civilized men likes and dislikes may be cultivated, hence people do not agree as to which odors are pleasant.

SMITH, CAPTAIN JOHN (1580–1631). The story of the life of Captain John Smith, as told by himself, reads more like a tale from the 'Arabian Nights' than like a true autobiography. According to his own account he ran away from his home in England at an early age, to seek adventure. While traveling through France he was robbed and left helpless in a forest, but was saved from death by a kindly peasant. Sailing from France with some pilgrims bound for the Holy Land, he was thrown overboard by his companions because they regarded him—a Protestant heretic and unbeliever—as responsible for the storm by which their lives were threatened. He saved himself from the sea, however, and later fought in a war against the Turks, three of whom he killed in a single combat. He was afterward captured and sold into slavery by the Turks, but made his escape by killing the guard placed over him. After wandering through Europe, he returned to England in 1605, and joined an expedition which was preparing to go to America to found the colony of Virginia.

During this voyage Smith's life was again in danger. He was accused of conspiracy, and at one time members of the party prepared to hang him. His life finally was spared, but he was kept under restraint until after the expedition reached the James River. Then it was found that Smith was one of the councilors who had been appointed by the Virginia Company in England to govern the colony. Soon he was forced by the incompetence of others to take the lead in the Jamestown settlement. He compelled all to work by his famous order, "He who will not work shall not eat." He forced the Indians to supply the starving colonists with corn, and at the same time kept the savages in order.

Soon after the settlers landed, Captain Smith had a very exciting adventure. It was generally believed that the "South Sea" (Pacific Ocean) lay just beyond the mountains, so with a few companions Smith sailed up the Chickahominy River in search of it. When the stream became too shallow to go farther by boat, he landed and with one Indian pushed forward through the forest. Soon he was set upon by a band of hostile Indians and made captive. They were about to shoot him with their arrows when he aroused their curiosity by showing them his pocket compass, and they spared his life. After taking him to many of their villages, they finally brought him before their chief, Powhatan, a tall stalwart man dressed in a coonskin robe. Presently the Indians seized Smith, bound him, and laid his head upon a stone, while a warrior stood ready to slay him with a club. At this moment, according to Smith's account, Powhatan's little daughter Pocahontas sprang forward, clasped her arms about the captive's neck, and prevailed upon her father to spare his life and send him back to Jamestown. The truth of this romantic story is doubted by many, but the value of Captain Smith's services to the colony is acknowledged by all.

CAPTAIN JOHN SMITH BATTLES THE TURK

Captain Smith, as the champion of the Christians, killed three Turkish champions in turn. At this period (about 1600) the full suit of war harness had already gone out of use for common soldiers, but was still worn on special occasions by great nobles, and as you see here, by chosen champions.

While out on one of his many exploring expeditions Captain Smith was wounded by an explosion of gunpowder, and in 1609 he returned disabled to England, and never again set foot on Virginian soil. After recovering from his wound, however, he explored and charted the coast of southern Canada and northern United States, to which at his request Prince Charles gave the name of "New England." He also spent much time in writing, and although his works are not fully reliable, his 'True Relation of Virginia', his 'Travels', and his 'General History of Virginia' still furnish us much valuable information concerning the Jamestown settlement.

Doubtless Captain Smith was something of a kindly braggart and had an over-vivid imagination. But most certainly he was also a very active, courageous, resourceful gentleman—"ever hating baseness, sloth, pride, and indignity more than any dangers"—and to him more than to any other one man was due the success of the first colony in Virginia.

Smoke. The vapor produced by burning any substance, usually wood or coal, is called smoke. The smoke from burning wood is almost colorless, and consists mainly of carbon dioxide and water, while that from burning bituminous coal is darker, being mixed with an oily vapor and soot, which is finely divided carbon. Acetylene gas, unless used in a special burner, gives a very smoky flame, caused by the great excess of uncombined carbon.

The more perfect the combustion, the less is the smoke. The remedy for the clouds of smoke which come from factories, foundries, and innumerable fires in many of our cities is more perfect combustion of the coal used, which also means economy of fuel. A smoke investigation in Chicago showed that the chimneys of that city were pouring out every year nearly 200,000 tons of solid matter.

Smoke in the air is one of the causes of fogs. When the temperature falls at night, moisture condenses on the small particles and they remain suspended in the air with their burden of water. The fogs of large cities, like the famed fogs of London, are largely due to incomplete combustion of fuel in the multitudes of furnaces and stoves, and the consequent production of smoke.

SMUTS, JAN CHRISTIAAN (born 1870). In the final struggle of the Transvaal Boers against the British which culminated in the Boer War of 1899–1902, there were few leaders who were abler or more devoted to the Boer cause than Gen. Jan Smuts. He was the descendant of a long line of Dutch farmers, but after graduating from a Cape Colony college, he had a brilliant career at Cambridge Univ. rsity, England, where he had studied English constitutional history and law with Frederick William Maitland, the greatest living master of these subjects. On returning to South Africa he had soon attracted the attention of President "Oom Paul" Kruger, who appointed him state-attorney of the Transvaal when he was but 28 years old. Then when the Boer War came he won great praise as a general for his skill in carrying out rapid movements; no leader more skilfully evaded the traps set by the British, and none did more to delay the final crushing of Boer resistance.

JAN SMUTS
Boer Soldier and British Statesman

Yet less than a score of years later this brilliant enemy of British rule had become the prime minister of the whole British Union of South Africa, and was recognized as one of the greatest living statesmen of the British Empire.

In the reorganized Transvaal he had become the right-hand man of Gen. Louis Botha, the leader of the People's Party, and in 1906 had journeyed to England with him and received from the Liberal leaders of the British government the promise that the Transvaal should receive self-government. In return Smuts and Botha promised loyalty on the part of the Boers to Great Britain, a promise which they kept.

Smuts played a considerable part in bringing about the Union of South Africa (1909), and when Botha became prime minister of the Union, Smuts was made minister of defense of the interior, and of mines. He was one of the few British colonials who realized that Germany was preparing for a great war, and he feared that the Germans would use native troops—as they did—in the attempt to sweep the British from South Africa.

When the World War broke out in 1914 many of the Boers, stirred up by Germany, sought to free themselves from British control by rebellion. But Smuts and Botha had promised loyalty to the British Empire and they kept faith; they put down quickly and harshly the Boer rebellion. Then Smuts led a military expedition across the desert of German Southwest Africa, and won that territory for British rule. He headed the expedition to German East Africa, where his military strategy won reluctant praise even from German army critics.

By this time Smuts had been marked out in Britain as an important military and political figure, so he was summoned from South Africa to represent that country in the Imperial War Conference. Then he was invited to attend the meetings of the British War Cabinet, and at the close of 1918 was employed in secret negotiations with Austria for peace. During the last year of the war, he made many speeches in Britain, speeches that won world attention and marked him off as the great spokesman for British Liberal opinion. He never doubted the outcome of the war, such was his faith in the final victory of moral issues; they were stronger than armies and would prevail. He did a great deal to keep up the spirits of wearied Britain. Like President Wilson he hoped for a new world after the war; like Wilson he wished for just boundaries based upon nationality, dreamed of a peace treaty that would bring about the reconciliation of nations and make for the ending of wars, and favored a League of Nations. But he was never so optimistic as Wilson; he never was so sure that the League of Nations could be established full-grown.

General Smuts went to the Peace Conference as the representative of South Africa. He helped frame the Covenant of the League, but he was dissatisfied with the spirit of the conference. He signed the treaty but issued a statement criticizing it.

Upon Botha's death in 1919, Smuts became prime minister. In 1924 he was defeated by Gen. J. B. M. Hertzog and the combined forces of the Labor party and the Nationalists who wished to cut loose from the British Empire. Smuts again became premier in 1939, when Hertzog refused to declare war on Germany. In a four-hour parliamentary debate he defeated Hertzog by the narrow margin of 13 votes and swung South Africa to war beside Britain. During World War II, the shrewd counsel of Africa's most distinguished son was often followed by statesmen of the Allied cause.

SMYRNA (*smĕr'nȧ*), TURKEY. The Turks call Smyrna "the eye of Asia" because, through its beautiful harbor on the Aegean Sea, Asia looks toward Europe. It is the most important seaport of Asia Minor, and one of the oldest cities in the world. Its native name is Izmir (*ĭz-mēr'*). A ruined fortress on Mount Pagos, above the city, built by a general of Alexander the Great, is one of the few remains of Smyrna's early greatness. The city was ancient even in Alexander's time. Pindar, the Greek poet, mentioned it in an ode written about 500 B.C., and it was one of the seven cities that claimed Homer. Polycarp founded an early Christian church in Smyrna, where he was martyred in A.D. 155. Greece, Rome, and Byzantium ruled the city in turn. It was repeatedly seized by the Turks, was sacked by Timur Leng (Tamerlane) in 1402, and in 1424 was finally subdued by the Turks.

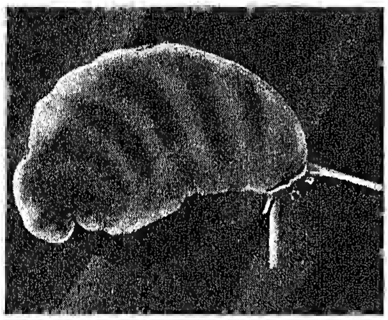
At the close of the World War Greece was given a mandate over the district, but in 1922 Turkey recaptured it. A few days after the capture fire destroyed most of the city and thousands of Greek and Armenian refugees lost their lives. The Treaty of Lausanne (1923) returned Smyrna to Turkey, and the large Greek population was exchanged for Turks living in Europe. In 1928 the city was leveled by an earthquake.

Once more Smyrna is recovering. Along the water front a new model city is growing. Here are the permanent grounds of the International Fair, held annually since 1933. Here, too, is the Bourse, where exporters buy the famous Levantine figs, the Sultana raisins, and the tobacco from the fertile mountain valleys. These products are prepared for export in large packing plants. Rugmaking is important, but has been degraded with the use of aniline dyes and machine weaving. Population, about 170,000.

The SLOW-FOOTED SNAILS *and Their* STRANGE WAYS

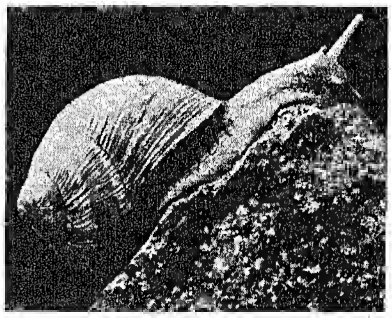
Some of the Remarkable Habits of These Creeping Creatures — Those that Own Their Own Homes, and Those that Live in the Open Air—How They Scrape Up Their Food with Tiny Files

SNAILS AND SLUGS. Dull creatures, you find the snails at first, and dismiss them as not worth your interest. But wait! Did you know that snails have a highly developed "homing" instinct by which they find their way back to their hiding places in the most wonderful and mysterious way? Did you know that a snail weighing less than half an ounce has been known to drag more than a pound of weight over a smooth table? Did you know that if a snail loses one of its "eye-horns," it simply grows another? Did you know that a snail can crawl across the edge of the sharpest razor without cutting itself? These are just a few of the interesting things about these queer mollusks.



You are looking at this Snail through a pane of glass. With the aid of the "glue" it manufactures and the wave-like movement of its "foot," it can crawl safely and steadily over the smoothest, steepest surface.

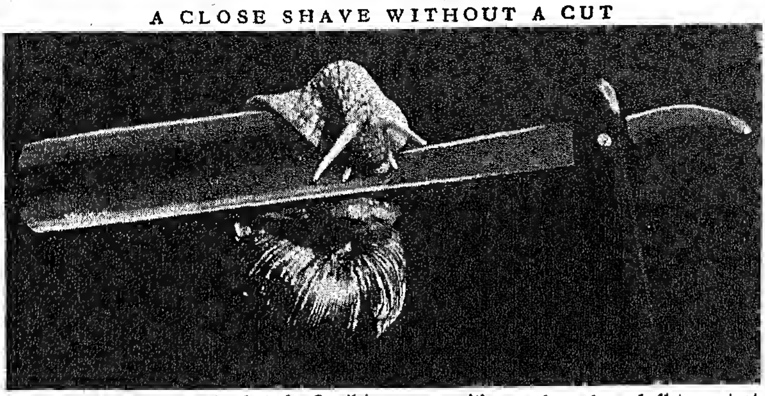
There are two great classes of snails—those with shells, and those without. Those that live in shells have a coiled body which fits into the coil of their shell; this shell they carry about with them. Their bodies are provided with strong muscles by means of which the body can be withdrawn entirely within the shell when danger threatens. Some snails have a horny disk on the foot which is just the size of the opening of their shell. When the snail is fully withdrawn within the shell this horny disk just closes the opening, and thus the soft body is completely protected. Other snails seal up the doors of their houses with a slimy substance which hardens, and in this sealed-up condition they can live through a dry period which would otherwise kill them.



In its slow-going travels, the Snail drags its coiled shell along on its back, while its horn-like eyes are extended, turning inquiringly from side to side. If disturbed, however, horns and all are drawn back into the shell.

Some land snails, commonly called slugs, have no shells, or only very tiny scales, on the back. Their bodies are soft, yet muscular and tough, and are straight, not coiled. The common garden slugs are small, black, or dark brown, and less than an inch in length when fully extended. Another species which is becoming common is the "great gray slug." This is a handsome creature, being light gray marked with black, and often reaches a length of four inches. It was brought into the United States some time ago from Europe. The sense of smell is very delicate in slugs, and they are able to detect the presence of food at long distances. Some slugs are very destructive to lettuce and cabbage leaves, as well as to fallen fruit. In Europe they are serious pests.

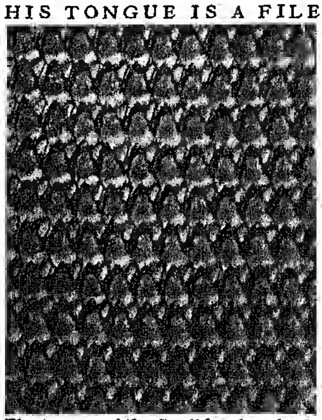
A CLOSE SHAVE WITHOUT A CUT



Perhaps you have thought that the Snail is very sensitive, and needs a shell to protect him. So he does, but the skin of his foot is very tough and so made that he can climb gracefully over the edge of the sharpest razor without injury.

Snails live in salt water, in fresh water, and on land. They feed mostly on plant material, though many are flesh eaters. They cut or shred their food to pieces by means of a peculiar ribbon-like apparatus in the mouth, which is called the *radula*, a word that means "little file." The eyes, which look like tiny black dots, are located at the tips of the long antennae, or tentacles, or at the bases of the smaller pair. (*See* Eyes.) A snail can be made to withdraw the tentacles which bear the eyes by flashing the sunlight on its head with a mirror. This shows that the eyes are sensitive to light, though they are not sufficiently developed to give images of objects.

HIS TONGUE IS A FILE



The tongue of the Snail has hundreds of tiny "teeth," with which it files away bits of food. This photograph shows some of the teeth, magnified 40 times.

Many snails, both water and land forms, breathe air, as the mammals do. These are called the "pulmonate" snails. Their lungs are simple and saclike, and are located about the middle of the body, nearer to the head than to the tail. The breathing pore opens and closes from time to time, and can be easily seen on the back near the head, a little to one side. Snails which breathe in the water are provided with delicate fringes of leaflike gills, like those of the clam, the oyster, or the fish. Over these gills pure water is kept flowing, and from this the blood takes the oxygen. These snails, therefore, do not need to come to the surface to get air. The big marine or saltwater snails, like the whelks and winkles, which live on the bottom of the ocean, breathe in this way.

Snails multiply by laying eggs, often in wonderful capsules. Those that live on land hatch out directly as little snails; but those that live in the water come out of the egg as very minute creatures which go swimming freely through the water by means of numerous fine vibrating hairs ("cilia") located at various portions of the body. Soon the little ciliated young, or larvae, settle down, lose their cilia, and develop into snails.

Those that build shells add coil after coil to their houses as they grow, building it up from the "front door" as fast as they need more room. Some of the most beautiful of animal structures are the snail shells, especially those which come to us from tropical waters. (*See* Shells.)

Snails crawl upon the flattened under-portion of the body, which is called the "foot." This foot is very tough and muscular, though soft and smooth, and contains, in many kinds, little glands which pour out slimy fluid that makes it easy for the snail to glide.

The rocks on sea-coasts are often almost covered with little marine snails of many different species. These small forms are known as periwinkles. The commonest one is nearly globular, or ball-shaped, and is a very dark gray. Another pointed yellowish shell is inhabited by a snail known as the oyster drill, because it makes round holes in the shells of the oyster, upon whose soft flesh it feeds.

Several species of the shelled snails can be found commonly in ponds and streams feeding on the leaves of the water plants.

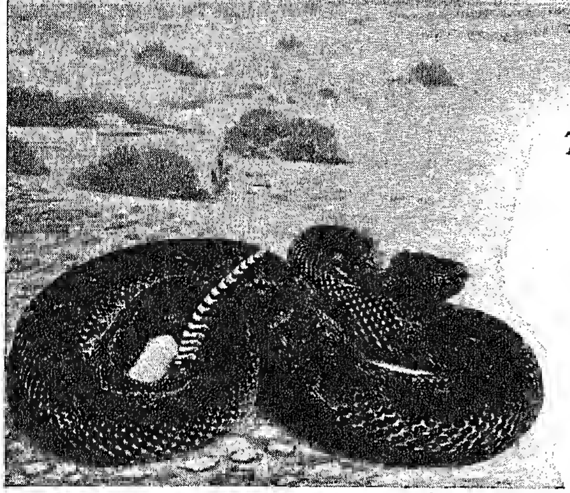
A large European land snail is eaten in France and Italy and is considered a great delicacy. Periwinkles also are eaten in England.

Snails and slugs belong to the gastropods, the largest of the mollusk classes (*see* Mollusks).

THE CARRIER SNAIL WRAPS HIMSELF IN STONE

The Carrier Snail, which lives in Borneo, is not satisfied with the protection he gets from his shell. He hides even the shell by covering it with small stones and bits of rock, which he fastens on with a cement he manufactures.

CREATURES *that* WALK *on* THEIR RIBS



The Queer Habits of the Cold-Blooded Reptiles Who Have Lost their Legs and Who Can't Close Their Eyes

SNAKES. As far as we can go back in history, we find that snakes have exerted a strange fascination upon men. In olden times they were worshiped as gods or friends of the gods; they were symbols of wealth and knowledge, and the "wisdom of the serpent" was the subject of many a proverb. Among the Greeks they were dedicated particularly to Aesculapius, the god of medicine. The part which the serpent played in the Garden of Eden is well known. In the Middle Ages they became associated with black magic and evil spirits, and countless myths center about monstrous serpents guarding treasures in caves, or dwelling in the depths of the sea. The majority of people even in civilized lands continue to look upon snakes with unreasoning fear and dread. How often you hear the remark: "I can't tell you why, but snakes make me shudder!" It isn't the danger of being poisoned that causes this, for the feeling exists toward snakes that are known to be harmless and gentle.

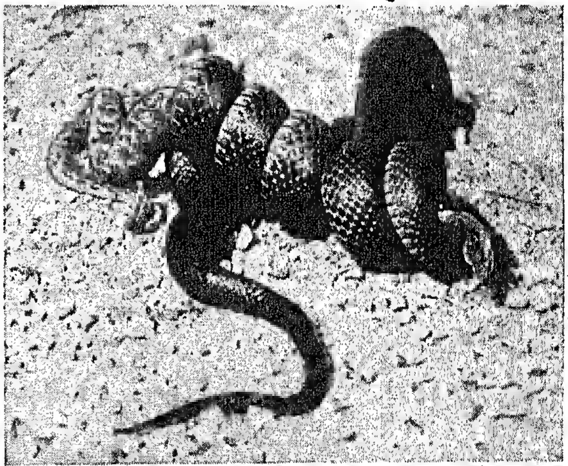
The fact is that snakes are indeed uncanny in appearance and habits. In the first place, they never close their eyes. They can't, for *they have no eyelids*, but only a tough transparent membrane to protect the eyeballs. This gives them that "cold and glassy stare" with which they are popularly supposed to hypnotize their prey. Another "creepy" spectacle is to see a snake crawl out of its old skin, appearing clean and glossy in its new dress. This habit formerly led people to believe that snakes were able to renew their life from time to time, and that they never died. Even when cut in two, the two parts were wrongly supposed to crawl together again and be mended.

How Do Snakes Get About?

But more impressive and mystifying than anything else is the motion of snakes. Their legless bodies seem to flow like living streams of water, with apparently nothing to push them or pull them. They crawl over stones, up the trunks of trees, wind themselves in the most intricate coils, then untangle again, rear their heads in the air, or glide through some narrow hole—all without seeming to exert a single muscle or move a single bone.

The secret of this is that a snake *walks with his ribs*. These are very many in number, each being fastened to a section of the backbone, and each section of the backbone being connected with its neighbors by ball-and-socket joints, which permit the greatest freedom of movement. The tips of each opposed pair of ribs are attached with muscles to one of the cross-wise scales of the abdomen. Thus the snake can move each of these scales independently, so that they act as feet, their sharp edges catching on any small roughness in the path of travel, and as they are drawn backward, pushing the snake's body ahead. When snakes are in no hurry, they usually move in a perfectly straight line, but for speed they throw their bodies into a series of *S*-shaped curves. In this manner many of them are able to get over the ground with amazing swiftness. No snake, however, is able to leap off the ground by the power of its coils, as might be imagined from the reports of certain travelers. Despite the lightning-like stroke of an angry snake, it never succeeds in propelling itself farther than its own length.

A KING SNAKE CONQUERS

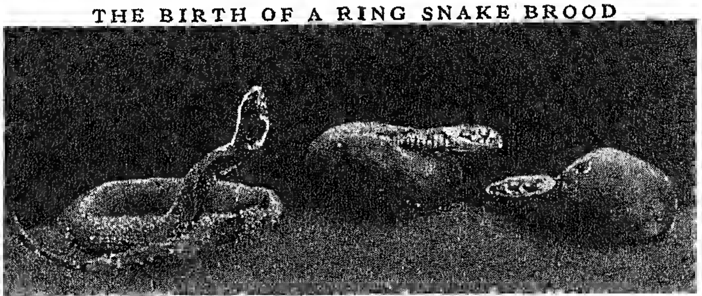


This is a battle to the death between a King Snake and a Copperhead. You can see how the King Snake has coiled around his weaker foe, whose fanged head is already hanging powerless.

Snakes are silent secretive creatures. They appear and disappear with soundless mystery. When cor-

nered and excited they have no voice, except a long sinister hiss. Wild animals in general appeal to us by their cries, like a half-understood language. We love the cheerful humming of the bee, the chirp of the cricket, the croaking of the frog; we can even find something remotely human in the bellow of the alligator or the howl of the wolf. But snakes can make no such appeal; even the noise of the "rattler" has a "dead inhuman sound."

THE BIRTH OF A RING SNAKE BROOD



The Ring Snake is one of the species which lays eggs. Two of these young snakes are just breaking through their shells, while a third is stretching himself for the first time.

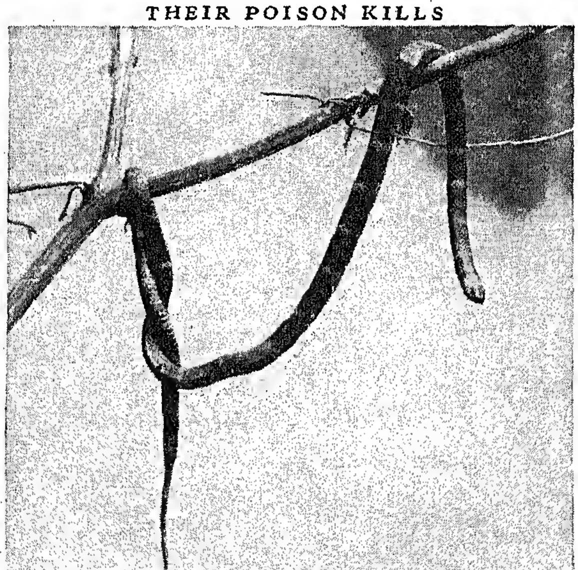
Yet when you see a snake's deep-cut mouth, curved back as in a cruel smile, and catch a glimpse of the forked tongue, darting in and out like an electric spark, it seems as if the creature could speak if it only would. In fact, however, this exhibition denotes chiefly fear and curiosity. The snake would gladly escape if it could, but instinct tells it that its long thin body is in great danger when stretched out flat on the ground; a slight blow will break its back. So it coils and hisses hoping to drive you away; and its forked tongue, which is believed to be a sense organ like the feelers of insects, is extended from its sheath on the lower jaw in the hope of finding out what sort of a being you are.

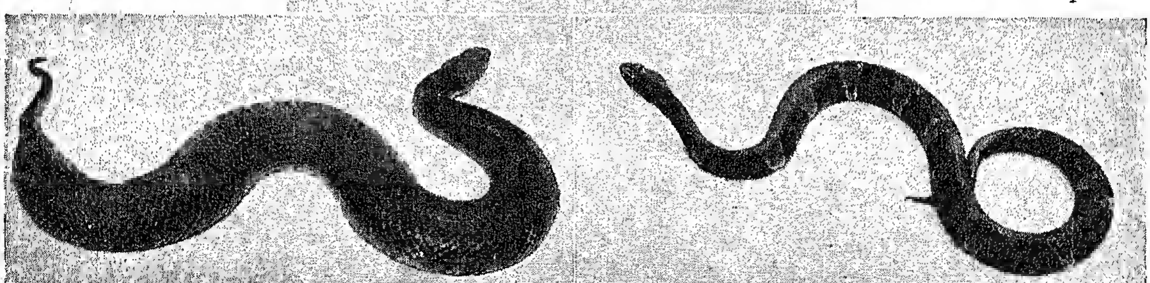
The prejudice against snakes has always blocked a better knowledge of them, yet they present an opportunity for a fascinating study. As we shall see later, there are only four kinds of poisonous snakes in North America outside of Mexico. Comparatively few people are killed by their bites, because the snakes usually do everything in their power to avoid contact with men. The victims of most of the fatal accidents are persons who become careless with captive snakes.

Nearly all snakes catch and kill their prey, which, according to the snake's size and habits, may consist of insects, fish, frogs, lizards, other snakes, birds and their eggs, rats, mice, rabbits, gophers, and other small mammals. Many snakes, like the boa constrictor and anaconda of South America, the common king snake of the United States, and others, wrap themselves around their victims and crush them by constricting or drawing together the folds of their bodies. The constricting power of a 20-foot anaconda is doubtless great enough to kill a cow, but stories of these snakes devouring cattle, horses, or men are untrue. (*See* Boa Constrictor.) The poisonous snakes usually rely on their venom to put an end to the struggles of their prey. The others simply swallow their catch without attempting to kill it first. This accounts for the fact that snakes which are disturbed immediately after a meal sometimes disgorge live frogs, lizards, etc.

The size of the morsels which snakes can swallow is astounding and indicates one of the important

THEIR POISON KILLS





Here are the three snakes which, with the Rattler, are the only poisonous snakes in the United States and Canada. At the top is the Coral Snake, a small creature with red, yellow, and black rings around its body. The heavy-bodied snake below is the Water Moccasin, while the one with the light and dark patches is its near relative, the Copperhead.

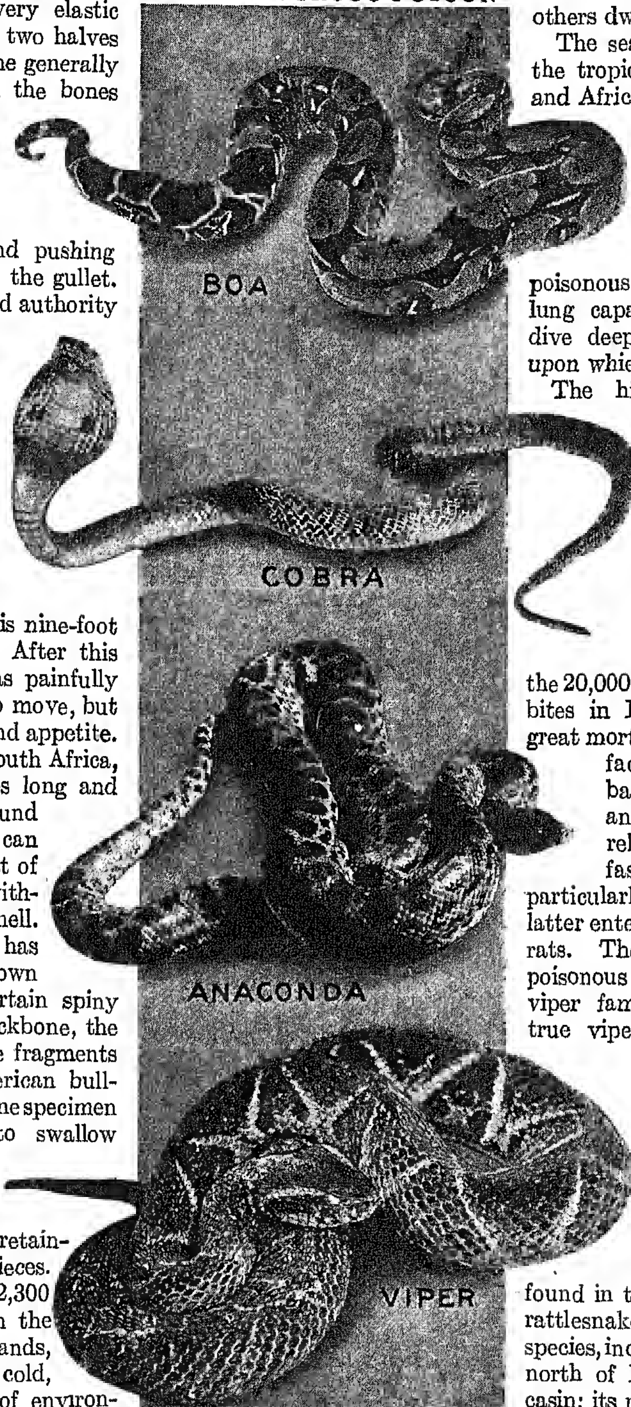
peculiarities of a snake's structure. This consists in the very elastic connection between the two halves of the lower jaw, and the generally loose attachment of all the bones around the mouth and throat which permits wide stretching. The teeth are sharp and curved backward, well suited for gripping and pushing the prey far down into the gullet.

A story is told on good authority of two captive boa constrictors which started to swallow the same pigeon from opposite ends. When their noses met in the middle, both were either unable or unwilling to stop their meal. The result was that one which was slightly larger swallowed the pigeon and his nine-foot brother snake as well. After this dinner, the survivor was painfully distended and unable to move, but soon recovered health and appetite.

The "egg-eater" of South Africa, which is rarely 20 inches long and not much bigger around than a man's finger, can perform the amazing feat of swallowing a hen's egg without breaking the shell. When the egg, however, has passed a few inches down the neck it strikes certain spiny projections from the backbone, the shell is broken, and the fragments vomited out. The American bull-snake is less particular, one specimen having been known to swallow 14 eggs in succession, crushing the shells by pressing its stomach against the ground, but retaining and digesting the pieces.

There are about 2,300 species of snakes. With the exception of a few islands, and regions of extreme cold, they exist in all sorts of environment—in dense tropical forests, in deserts, on high mountain tops. Some burrow in the ground, some live entirely on the surface, some spend most of their time in trees; others frequent swamps or fresh-water lakes and rivers; and still others dwell in the sea.

MUSCLE VERSUS POISON



The Boa and the giant Anaconda are among the most powerful of all snakes, catching and crushing their prey in their powerful coils. Yet the Cobra and the Viper, small as they are in comparison, can kill creatures the other two would not dare to attack, for they possess deadly poison fangs. These pictures, of course, do not show the relative sizes.

The sea-snakes, found mostly in the tropical waters bordering Asia and Africa, usually have the body flattened from the sides, which makes them powerful swimmers, but awkward on land. They number about 50 species—all exceedingly poisonous. They have tremendous lung capacity, so that they can dive deep in pursuit of the fish upon which they feed.

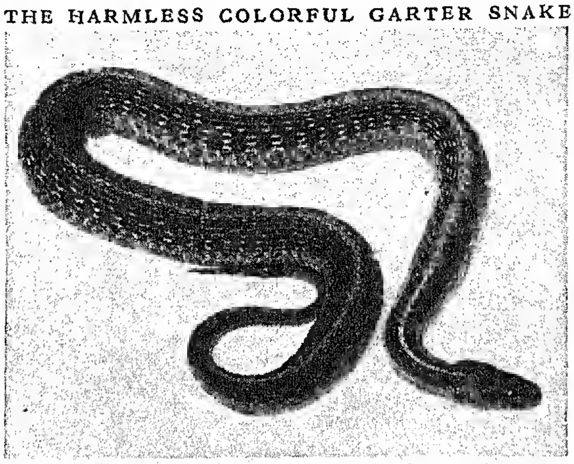
The highly poisonous snakes found on land number not more than 250 species, of which 150 belong to the sub-family called *Elapinae*, which includes the cobra and the "krait," the two most dangerous of all snakes, and which are chiefly responsible for the 20,000 annual deaths from snake bites in India (*see* Cobra). This great mortality is chiefly due to two facts; that the Hindus go barefooted through fields and jungles; and that, for religious reasons, they steadfastly refuse to kill snakes, particularly cobras, even when the latter enter their houses in search of rats. The remaining 100 highly poisonous snakes belong to the great viper family, which includes the true vipers (*Viperinae*) and the pit-vipers (*Crotalinae*). The latter group contains the rattlesnakes, the moccasins, the deadly "fer-de-lance," the bushmaster, etc. (*see* Vipers).

The only kinds of poisonous serpents found in the United States are the rattlesnakes, of which there are 16 species, including the pigmy rattlers, north of Mexico; the water moccasin; its near relative, the copperhead; and the coral snakes, with two species (*see* Copperhead; Moccasin; Rattlesnake). It is important to know them all, particularly the copperhead and moccasin, for they resemble many of the harmless

snakes. Such knowledge not only protects human beings from harm, but tends to stop the wholesale destruction "on suspicion" of all snakes, many of which are of great value to the farmer, as they eat up quantities of insects, rats, mice, gophers, prairie dogs, and other pests.

The coral snakes are among the prettiest of all reptiles. They are ringed with brilliant colors, and appear harmless and gentle. Yet they are of the same family as the deadly cobra, and their tiny fangs, which they sometimes use with treacherous swiftness, inject a poison of fatal strength. The two species in the United States are the "harlequin" and the "Sonora" coral snake, the former found throughout the South, the latter confined to Colorado and Arizona. They may be distinguished from certain harmless snakes of similar patterns by the fact that the colored rings are arranged in the following order: red, yellow, black, yellow, red. Even so, it is best not to place trust in a hasty identification.

THE HARMLESS COLORFUL GARTER SNAKE



The Garter Snakes are the most numerous and most widely distributed of all American snakes, being common in all sections except the arid western regions. Their favorite haunts are grassy meadows and the borders of streams.

The venoms found in poisonous snakes are usually clear yellowish liquids, which get their deadly power from certain highly complex chemicals of the proteid class. When the snake strikes its victim this poison usually enters the tissue immediately beneath the skin and from there is absorbed into the blood and distributed through the system. All snake poisons act principally upon the nerves with a paralyzing effect, beginning with weakness in the legs and arms, which quickly spreads to the entire body, followed by spasms, labored breathing, coma, and death.

The Poison of the Deadly Cobra

Cobra poison, which is considered the most deadly of all, creates at first a burning pain in the wound. One of its characteristic effects is to make the victim speechless after a few minutes. Rattlesnake poison, while less deadly, is more violent in its action upon the system, causing staggering fits, vomiting, swelling of the limbs, and acute spasms. There is danger that the person who survives the first effects of a rattlesnake bite may die weeks afterward from gangrene, which often sets in at the place where the poison entered the body.

In treating any snake bite the first thing to do is to tie a string or rope above the wound and twist it tightly with a stick. Then gash the wound freely to make it bleed. Thereafter, drain it by pressure or by means of suction cups at frequent intervals. It is no longer believed advisable to cauterize the wound or apply permanganate of potash. Small doses of some active stimulant should be administered to keep up the heart action, but large quantities of alcoholic liquors are very harmful. The string or rope must not be left on for more than half an hour or gangrene will set in. Antitoxins or "antivenins," as they are called, have been produced which are useful to snake collectors and others who handle poisonous reptiles. They are injected into the blood like other serums (*see* Antitoxins).

In addition to the highly poisonous snakes mentioned, there are about 300 species of "semi-poisonous" snakes, which, either because of the imperfect arrangement of their fangs or because of the weakness of their venom, are unable to do much harm to large creatures. Only two unimportant members of this group occur in the United States.

This leaves a large majority of perfectly harmless species, which are made to suffer for the sins of their venomous relatives. In many parts of the world certain of these snakes are regularly regarded as valuable household pets, being clean and quiet and ridding their adopted homes of mice and rats.

And Snakes Make Lovely Pets!

Most snakes, indeed, soon become accustomed to human society and are tame and docile in captivity. The western bull-snake, which sometimes attains a length of nine feet and is the largest North American snake, is the favorite of the circus "snake charmers"; if it is fed enough eggs and poultry, it good-naturedly permits itself to be handled in the most careless fashion. The racers, which include the indigo snake, the blacksnake, the coach-whip, and the blue racer, are other large snakes which thrive in man's neighborhood, and, if they can be kept out of the chicken coop, perform considerable service in protecting crops from rodents. The coach-whip is perhaps the speediest and most active of all snakes, darting over the rough ground almost as if it had wings.

The rat snakes or *colubers*, including the corn snake, the pilot blacksnake, the fox snake, the chicken snake, are even more deserving of man's protection, for they regularly dwell in fields of growing grain and exterminate countless numbers of small harmful creatures.

But the most unjustly persecuted of all are the innumerable varieties of garter snakes—those graceful, delicately striped creatures, whose only offense is that, like many others of the snake tribe, they give off when first captured an evil odor. But even this habit disappears in a few days. As they feed chiefly

on small frogs, toads, fish, and worms, they cannot be classed as useful; but if the snake "curse" can be forgotten, they lend bright color to the life of the countryside. They are very prolific, a single mother producing from 25 to 75 young in a single season.

Harmless Snakes that Pretend to Be Bad

There are many harmless snakes, however, that are to blame for their own misfortunes, for they do everything in their power to imitate their poisonous brothers. The familiar hog-nosed snake is a good example. The cobra and the rattlesnake together cannot present a picture of such villainous ferocity as this small creature, which cannot even be induced to bite. It hisses, and spreads out its neck, and darts its upturned nose so viciously in every direction that many people call it the "puff-adder" and are convinced of its venomous nature. Yet if you approach boldly, the hog-nose, instead of making good its bluff, will turn over on its back and pretend to be dead, remaining stiff and immovable no matter what treatment it receives. The only way you can make it betray its sham is by placing it on its stomach, when it will roll over again on its back like a flash.

Many of the water snakes (genus *Tropidonotus*), which frequent the borders of rivers, lakes, and swamps, court death by imitating the deadly moccasin. The bites of these harmless reptiles, being mistaken for moccasin or copperhead bites, and subsequently "cured" by popular or quack remedies, are responsible for a dangerous amount of misinformation about the treatment for snake venoms.

If there is a hero among American snakes, it is the king snake, which belongs to a genus (*Ophibolus*) ranging in size from 14 inches to 6 feet. The common king snake is a powerful creature from 4 to 5 feet long, marked with a striking pattern of yellow or white bands, arranged like a chain on a black background. This powerful reptile does not, as is sometimes said, actually hunt out poisonous snakes, but it gladly attacks any it may chance to meet. And whether it be a giant rattlesnake or a small copperhead, the result is always the same—the king snake wins. It coils itself quickly about its astonished adversary and tightens its grip with such strength that the victim is soon strangled, and, if not too large, it is eaten. But the king snake's courage is after all not so great, for it is immune to snake poison.

Snakes belong to the suborder *Ophidia*. With the lizards (suborder *Lacertilia*), they form the order *Squamata* of the class *Reptilia* (*see* Lizards; Reptiles). In the older families, like the boas, the skeleton shows traces of hind legs, which have been lost in the process of evolution. In this respect they show their close connection with the lizards, some of which, like the "glass snake," have no external limbs.

Although snakes seem to hear very well, they have no external ears, such hearing apparatus as they have being hidden beneath the skin. Their body is covered with even rows of scales. These scales are enlarged into fixed shields on their heads. In all but the true sea-snakes, the scales of the abdomen are modified into narrow "scutes," each one reaching clear across the belly and overlapping its rear neighbor like a shingle on a roof. This arrangement, as we have seen, takes the place of legs.

The majority of snakes lay eggs, which are whitish with a tough outer shell; but most of the vipers and all the sea-snakes bring forth living young, as do also our common garter snakes. As soon as the young are born or hatched, they are able to shift for themselves, the poisonous varieties having fully developed fangs and venom sacks.

In cold countries snakes hibernate during the winter. All the members of the order are able to go an extraordinary length of time without food, and many live to a great age.

Snipe and Sandpipers. Among the shore birds snipe are a favorite with hunters and they are much pursued. The snipe family, which includes also the sandpiper group, has about 100 species, ranging in size from the woodcock, 11 inches long (*see* Woodcock) to the "least" sandpiper, 6 inches long. The Wilson's snipe, or jacksnipe, is a delicate bird in both taste and appearance. It breeds from the northern borders of the United States north to the Arctic Sea, and migrates down across the United States during the autumn, when it is much hunted. Flashing suddenly from the grass it darts off with rapid flight, uttering its call, "*scaip, scaip, escape!*" During the winter jacksnipe are very plentiful about the marshes of Louisiana.

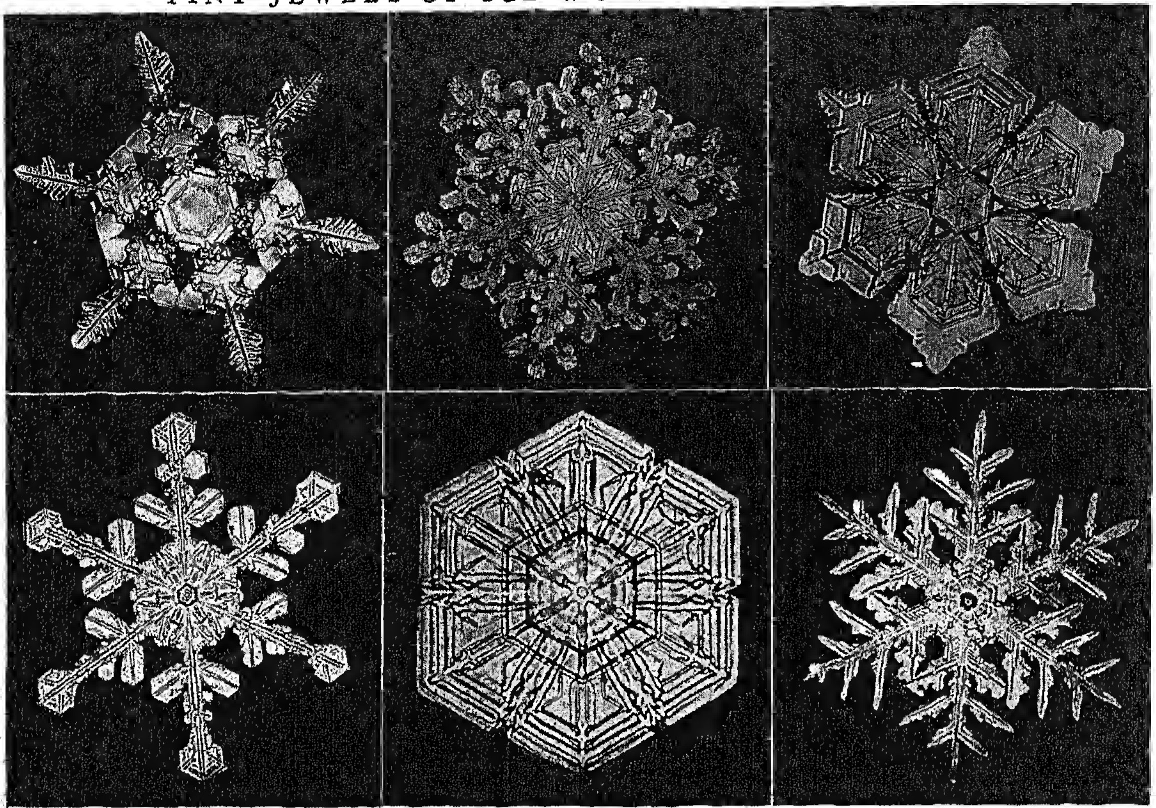
The red sandpiper, or "knot" (said to be named for King Cnut, or Canute, of England), is about the size of a robin, and in the summer has robin red-breast feathers. In the winter the breast feathers are grayish-white. After nesting in the far north, it migrates to the south, being found through Africa, India, Australia, and along the Atlantic coast of North America. The "least" sandpiper is the baby shore bird, and weighs no more than an English sparrow. With the long bill and legs of his family he is a curious little fellow. He nests north on the eastern and western coasts and winters in South America. During the mating season the male birds sing a little twittering song not unlike the song of a warbler.

The curlews, so called from their mournful cry *cur-lew*, also belong to the snipe family. Most species are of large size and they have exceedingly long slender downward-curving bills. The Eskimo curlew, or dough-bird, once found in great numbers in North America, is now, owing to the ruthlessness of hunters, almost extinct. The long-billed curlew and the Hudsonian curlew are now the most abundant species in America.

Snipe and sandpipers belong to the family *Scolopacidae*; scientific name of Wilson's snipe, *Capella delicata;* American knot, *Calidris canutus rufus;* least sandpiper, *Pisobia minutilla;* long-billed curlew, *Numenius americanus americanus;* Hudsonian curlew, *Phaeopus hudsonicus.*

Snow. In all latitudes snow forms out of the moisture in the upper air, but melts as it falls through the lower air, if this is warm. Thus from the Equator to latitude 30°, snow is almost unknown at sea-level; from latitude 30° to about 40°, it is an occasional winter visitant; from about 40° to 75°, it is generally present during a longer or shorter period in winter; in latitudes above 75°, snow falls on perennial snow, wherever there is land. At the Equator the snow line —the height above sea-level at which snow does not

TINY JEWELS OF ICE WHICH WINTER BRINGS



Snow is really ice, shaped into minute crystals. Often you will be able to catch single crystals in your hands and give them a quick study before they melt, but more often the flakes combine in groups before they reach the earth. Although they vary greatly in details, snow crystals all belong to the hexagonal system; that is, they all have six sides or angles.

melt—is about 17,000 feet above sea-level. From the Equator it descends to about 13,500 in latitude 30°, and 1,000 feet in latitude 70°. In regions of perpetual snow, the weight of one snowfall on another may, on steep mountain slopes, produce a snow slide or avalanche; on less steep slopes, the lower part of a snow field is changed to glacial ice (*see* Glacier).

One curious snow phenomenon is seen only in low latitudes where the tropical sun in some places sculptures the perennial snow of the mountains into fantastic colonnades so like processions of kneeling human figures that the South Americans call it the "snow of the penitents."

Because of the great amount of air it contains, snow is an exceedingly poor conductor of heat. Eskimos and explorers in the Arctic regions build *igloos* or huts of snow blocks, which can be kept surprisingly warm in even the coldest weather. Where winters are severe, the presence of the snow blanket protects the dormant vegetation beneath from fatal cold and keeps in the heat rising from the warmer layers of earth below.

Snow consists of water crystals, though sometimes the snow flake is a shapeless woolly tuft or pellet composed of débris of the typical six-sided crystals. Probably no other substance crystallizes in such an infinite variety of beautiful forms as water. Some crystals are flat or tabular, some are columnar needles, and some are compound structures, and the variations of these three classes are endless. The most numerous and beautiful are the flat crystals, some of which branch out into flowered rosettes, while others within the plain six-sided outline contain beautiful inlaid designs formed by tiny air tubes within the crystal structure. The most curious are perhaps the "cuff-button" doublets composed of a large and a small tabular crystal connected by a columnar needle. Crystals formed in the low clouds are usually large and branching; those from the high clouds are small and compact.

Not every snowstorm furnishes good specimens of snow crystals. The western, southwestern, and northwestern segments of great storms usually furnish the most perfect and beautiful crystals. You can imagine how difficult it is to photograph snow flakes before they melt, yet W. A. Bentley, of Vermont, the man who first accomplished the feat, has photographed more than 1,000 different forms.

Red, green, blue, and even black snow is occasionally seen in many parts of the world. The colors are due to the presence of innumerable tiny fungi, or to dust collected by the snow as it falls through the air.

The HISTORY *of a* CAKE *of* SOAP

SOAP. "Cleanliness is next to godliness," we are often told, and true cleanliness would be next to impossible were it not for soap. This humble article of everyday use was never so appreciated as in Europe during the World War, when the supply of raw materials was depleted and soap became difficult to obtain. In some of the war-ridden countries fabulous prices were paid for a cake of it, and in many places it could not be obtained at any price.

Indispensable as soap is to us, it was absolutely unknown until about the beginning of the Christian era. In earlier times people anointed their bodies with olive oil, and used juices and ashes of various plants and fuller's earth for cleansing purposes. Pliny, a Roman writer of the 1st century A.D., who makes the first reference to soap, speaks of two kinds, hard and soft, and mentions it as originally a Gallic invention "for giving a bright hue to the hair." In the ruins of the buried city of Pompeii a complete soap-making establishment was found and some well preserved cakes of the finished product, resembling closely the soap of today.

By far the largest part of the world's soap supply is used as shown here—to do the family laundry on washday. The United States consumes seven pounds of laundry soap for one of toilet soap.

Nearly three billion pounds of soap are produced yearly in the United States, where the greatest progress in its manufacture has been made. The chief producing centers are in Indiana, Ohio, Illinois, New York, California, Pennsylvania, and Missouri. Especially fine soaps are made in France, where Marseilles has long been recognized as the center of the soap trade, a position originally achieved because of its command of the olive oil markets.

The Chemistry of Soap

Soap is made by the action of alkali on fats or oils. A simple experiment will show you how alkali acts on grease. Put a spoonful of washing (lump) soda with a little water in a greasy frying pan and boil the mixture. In a few minutes the soda and grease will have broken up and the particles will have united to form a thick soap, which can be washed out, leaving the frying pan clean.

Soap, to most of us, means a cleansing substance which makes a lather in soft water. A chemist, however, will tell you that soaps are metallic salts of certain fatty acids. Some of these salts—those of sodium, potassium, and ammonium—are cleansing agents soluble in water; others, such as the lead soap used in pharmacy as a plaster base, are insoluble and useless as cleansers. We are concerned here only with two of the cleansing soaps, the sodium and potassium soaps, and particularly the former. A potassium soap is soft soap. Hard soap is a sodium compound; the degree of hardness depends on the character of the fat. Most commercial soaps are sodium soaps.

The discovery of the Leblanc soda process about 1791 (*see* Acids and Alkalies; Sodium) gave a great impetus to the soap-making industry of the early 19th century. It became organized on a scientific basis, however, only after the researches of the great French chemist Chevreul, published in 1823, showed the composition of animal fats (fatty acids in combination with glycerin) and the character of saponification (the substitution of the metal in the alkali for the glycerin in the fat). This is the essence of all soaps.

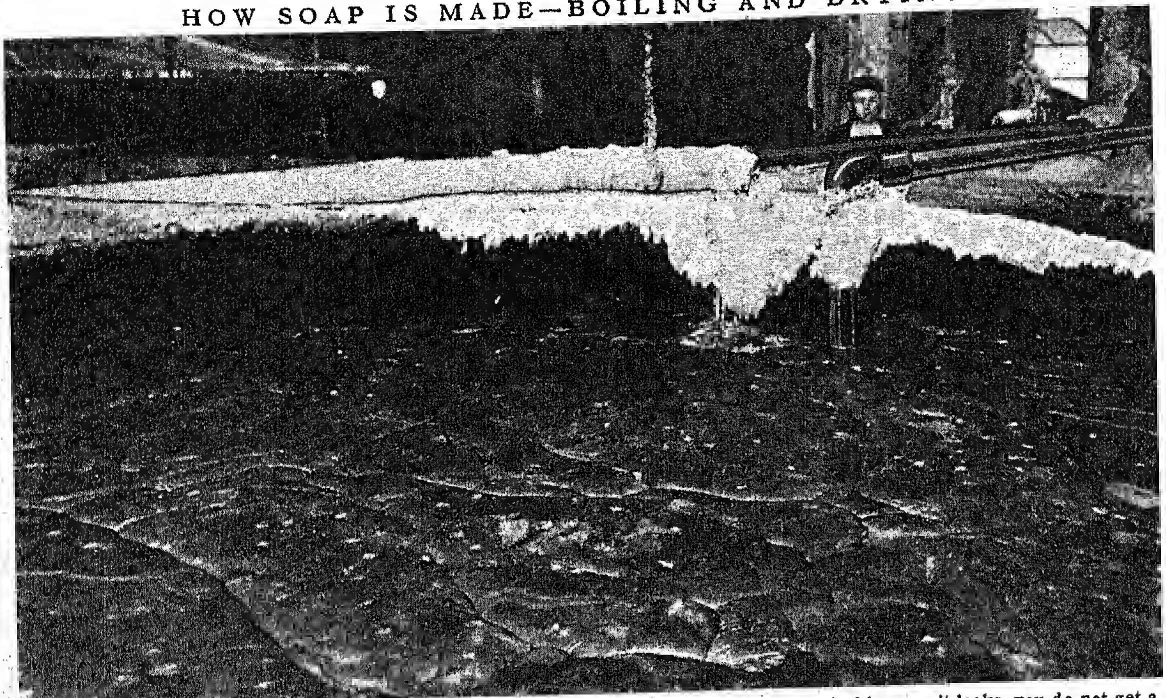
Now what happens when we wash our hands or clothing with soap? You know that our sweat glands are constantly giving off a certain amount of oil, which catches dust and dirt and soils our clothing. When soap is dissolved in water and rubbed on the hands or on soiled linen, it acts in two ways: First, it forms an *emulsion* with the oil, that is, a mixture in which the oil is held suspended in very fine particles, so that the oil can be washed out with the soap solution. Second, the very fine particles of soot and dust attach themselves to the tiny droplets of the soap solution, so they too can be washed out.

Plants that Act Like Soap

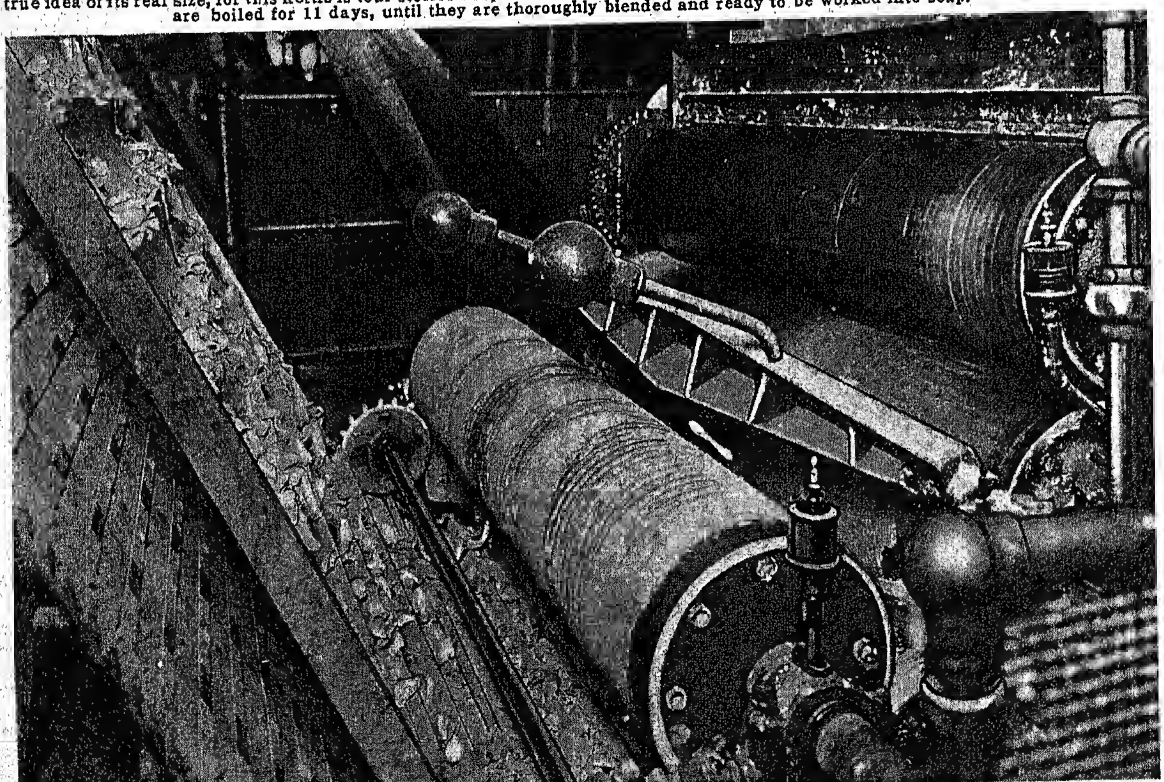
Certain plants, such as the common soapwort or "bouncing-bet" of the United States, contain a poisonous compound called saponin, which cleanses in much the same way as soap. In Chile and Peru the powdered bark of the soapbark tree (*Quillaja saponaria*) is used in washing fine fabrics.

Every household was its own soap factory in pioneer days. Our great-grandmothers used to save all the waste grease from their kitchens for "soap fat." For the saponifying alkali they used the lye obtained by leaching wood ashes—that is, pouring water through them to get a solution of potassium carbonate or

HOW SOAP IS MADE—BOILING AND DRYING



Here is the gigantic soap kettle in which the ingredients are boiled in a modern soap factory. And huge as it looks, you do not get a true idea of its real size, for this kettle is four stories deep and holds 275,000 pounds. It is heated by steam coils, and the ingredients are boiled for 11 days, until they are thoroughly blended and ready to be worked into soap.



After boiling in the kettles, the soap is allowed to cool somewhat and then is run through the rollers at the right. They are of granite and are chilled with water. They congeal the liquid soap and deliver it to the heated roller in the middle of the picture. This roller irons out the soap into chips and delivers the chips to the endless belt at the left, which carries the chips into the drier.

potash. At least once a year the accumulated soap fat was boiled up with the lye, usually in a huge kettle over an open fire in the back yard. The result was a yellowish soft soap. If the housewife wanted hard soap she "salted it out" with brine. The sodium in the salt and the potassium in the "soft soap" exchanged places. The resulting sodium compound rose to the top and cooled as a solid cake of hard soap.

Either vegetable or animal fats may be used. The vegetable fats used include coconut, palm, olive, cottonseed, and soybean oil. The ingredients in soap must "balance" exactly. An excess of fat would produce a greasy mass, useless for cleansing, and an excess of alkali would burn skin and rot fabrics.

Soapmaking in Modern Factories

In factories the manufacture of soap starts in big kettles made of steel plates. Some have a capacity of 175 tons, enough to make 10 or 12 carloads of finished soap. They are heated by steam coils. Inlet pipes admit the ingredients used and a cone-shaped bottom provides for drainage.

First the fats are run into the kettles. Then alkali is added. The alkali separates the fats into glycerin and fatty acids, and then combines with the fatty acids. The result is soap, and the process is called *saponification.* In making laundry and kitchen soaps the glycerin is thrown to the bottom by adding a saturated salt solution. In most higher-grade soaps more or less glycerin is left; but some soaps are made from free fatty acid without glycerin.

The soap is purified by several boilings, and left to cool for about two weeks. Then it is run into a *crutcher* and beaten smooth by revolving paddles. Perfume and coloring matter are added if desired. Resin, which gives laundry soaps their yellow color, is added to make them lather more freely.

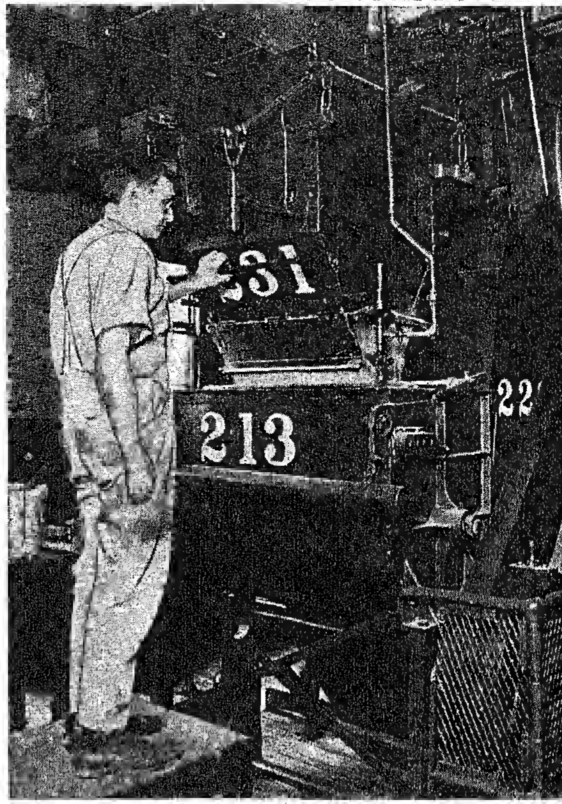
From the crutcher the soap goes into the frames, or molds, in the drying room. When the soap has hardened, the sides of the frame are stripped off and the blocks of soap are removed. They go into the cutting machines to be divided into bars, and the bars are dried, pressed into cakes, and wrapped.

Different Kinds of Soaps

Toilet soaps are made in much the same way, but with fats of better quality. Instead of going through a crutcher, they are dried and sent to a mixer, or "mill," where perfumes and coloring matter are added.

Transparent soaps are prepared either by dissolving ordinary soap in alcohol or by leaving some glycerin in the soap. In the first process the alcohol solution is decanted and the alcohol distilled off. The residue is a thick transparent jelly, which dries as a clear solid. Glycerin soap consists of glycerin and soap in about equal parts. An excess of glycerin makes liquid soap. Scouring soaps contain abrasive material. Castile soap is made with olive oil; but the term may also mean any fine, mild soap made with another oil. For example, "coconut castile" is a toilet soap made with coconut oil. *Naphtha* soaps contain naphtha or kerosene for cutting heavy grease.

PERFUMING THE MIXTURE



Here a scale (numbered 231) delivers measured quantities of chips to a mixer (numbered 213), where the perfume is blended in. Afterward, the soap is *milled* with granite rollers, and then molded into bars and cakes.

Shaving creams are soft soaps made with caustic potash and a slight excess of stearic acid. The brushless type contains glycerin or similar agents. Saddle and harness soaps have a little wax, which remains on the leather when dried. Shoe polish has more wax, plus a dye to match the color of the leather.

Special Detergents and Wetting Agents

Soaps and other cleansing agents are often grouped as *detergents.* The term comes from the Latin *detergere,* meaning "to wipe off." Doctors use the term for mildly antiseptic soaps such as "green soap," made from potash alkali and linseed oil, and for various cleansers used on wounds and ulcers.

Ordinary soaps do not work well with sea water or "hard" water, which contains dissolved lime or magnesium salts. These salts may coagulate the soap and prevent it from loosening dirt and grease effectively. Soaps for use with hard water contain a *builder,* such as sodium silicate (water glass), various sodium phosphates, borax, or sodium carbonate. The builder transforms the dissolved salts, so they do not hinder the action of the soap. Many soap powders contain a builder. Salt water soap is made with coconut or palm oil, caustic soda, and a builder.

The most powerful cleansers are special *wetting agents,* products of modern synthetic chemistry, some-

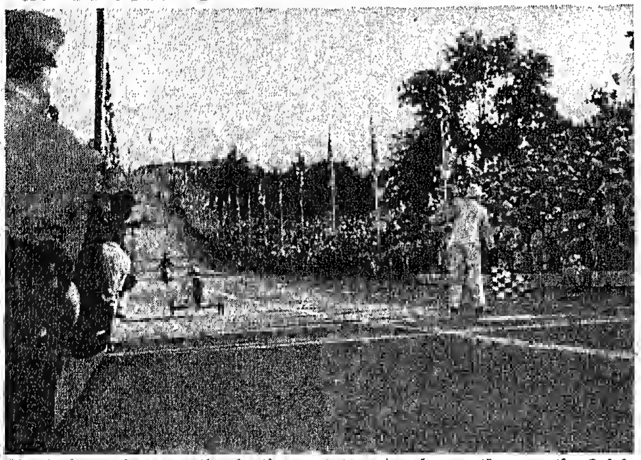
times called "soapless soaps." They have long chain-like molecules. One end of the chain consists of a water-soluble group or radical, and the other end of an oil-soluble group. Thus the molecules can act as links, bringing together into intimate contact substances that otherwise would not mix. Their physical effect, when added to liquids, is to break down their cohesion and surface tension (*see* Water) and thus permit them to penetrate under or dissolve all kinds of dirt. Ducks cannot swim in water containing one of these wetting agents, for it penetrates immediately the oily protection of their feathers. The ducks become soaking wet and sink.

These substances are now applied to the manufacture of washing powders, shampoos, tooth lotions, and germicides. They help to make lubricating oil more penetrating and dyes more effective.

SOAP BOX DERBY. A crowd of boys whooping in "soap box" coasters down a Dayton hill inspired one of the nation's outstanding amateur races. One day in 1933 a photographer for the Dayton *Daily News*, Myron E. Scott, watched the fun, then persuaded his newspaper to promote a city-wide race. Next year he interested an automobile company and a number of newspapers in sponsoring a national competition.

More than 100,000 boys in the United States and Canada came to compete in the preliminaries for the annual All-American and International Soap Box Derby. The finals, held at "Derby Downs" in Akron, Ohio, attracted more than 100,000 spectators.

AN EXCITING FINISH AT "DERBY DOWNS"



Cheered by 100,000 enthusiastic spectators, two boys roll across the finish line at "Derby Downs." The course is a concrete hill, 1,100 feet long and 30 feet wide, with a 16 per cent grade.

The Derby is open to boys from 10 to 15 years of age. It encourages not only sportsmanship but craftsmanship, for the racers must be built by the boys themselves, without any adult help except advice. These racers are gravity-propelled coasters. The course is a hill 1,100 feet long, down which they roll at a top speed of around 30 miles an hour.

Each year more skilful craftsmanship has gone into the winning cars. Wheel alignment, bearing adjustment, springing, weight distribution, tire pressure, and an efficient steering system are the most important factors. Success depends chiefly on the ability of the car to roll with a minimum of friction in the moving parts. Total cost of materials is limited to $10. The only parts which may be purchased ready-made are wheels, tires, bearings, axle rods, steering wheel and steering shaft, springs, and the hardware used in the construction of frame and body. No welding, brazing, soldering, or other processes beyond the average boy's capacity are permitted.

Newspapers promote the local races and send their winners to Akron. Chevrolet pays the boys' expenses in Akron and awards prizes. A four-year university scholarship goes to the champion. Suggestions for building cars and the rules governing races and equipment may be obtained from local newspapers or from the Chevrolet Motor Division, General Motors Sales Corporation, Detroit.

SOAP BUBBLES. Pretty things to amuse children, but not worth the attention of a serious student—that is probably what you think of soap bubbles. What would you say of a man who at 40, nearly blind and dependent upon the eyes of a daughter-in-law, made brilliant scientific discoveries by studying bubbles? A Belgian physicist, Joseph A. F. Plateau (1801–1883), did that, and enriched our knowledge of surface tension and other forces within liquids. His work, like Newton's two centuries before, proved that much may be learned from bubbles (*see* Newton, Isaac).

Why is a bubble round? For the same reason that a raindrop is round—because the "skin" formed on its surface by surface tension (*see* Water) tends to make the surface as small as possible. Since a sphere has the smallest surface for a given volume, raindrops, dewdrops, and drops of molten lead falling from a shot tower become spheres, so long as they are not so large that the force of gravity is able to break through the surface tension.

A soap bubble differs from a raindrop in having two surfaces—one inside, one out—and therefore having twice as much surface tension. It contracts until stopped by pressure from the contained air. Since gravity continually drains water from the top of the bubble, the upper walls become thinner and soon break. A soap bubble, however, lives longer than a bubble of pure water, because soapy water has less surface tension, making for less power to contract, than pure water has; and also because of a remarkable property by which the surface tension varies and the bubble mends itself, so to speak, from instant to instant. Bubbles of special soap solutions with glycerin have been kept for days under favorable conditions; one is recorded that lived nearly a year.

What causes the beautiful play of colors in a soap bubble? The inner and outer surfaces act as mirrors; the space between varies in depth and acts as a prism. Thus, light passing between these surfaces is reflected,

refracted, and subjected to interference (*see* Light). When interference blocks one color, we see the complementary color. Constant changes in the thickness of the bubble cause the shimmer of color.

Why does a bubble rise at first and then sink? Your breath which blew it is warm, and warm air is lighter than cold. You can float a cold bubble, though, on the surface of a gas heavier than air, such as carbon dioxide or ether; it floats until the heavy gas gains admission to the bubble.

SOCIAL INSURANCE. Few wage earners can save enough to support themselves and their families in time of unemployment or sickness, or in old age. To help them meet these hazards of industrialism, many countries have established state aid systems called *social insurance.* The chief forms are unemployment insurance, accident compensation, old-age pensions, benefits for persons unable to work, pensions for needy mothers and widows, and sickness insurance.

Payments are made from funds raised by taxation, usually by taxes on employers or employees, or both. Social insurance, unlike commercial insurance, is not based on an "actuarial rate"—that is, workers do not pay premiums which vary according to the risks and losses expected. Hence it is not insurance in the strict sense, and in the United States the term "social security" is more generally used.

Although social insurance legislation is relatively recent, the idea is not new. It appeared as early as the Middle Ages, when the craft gilds helped members and their families by providing benefits for sickness and death. When the Industrial Revolution later brought great numbers of workers from the country into city factories, trade unions provided some relief for their distressed members, but most wage-earners in time of stress had to fall back on charity (*see* Poor Relief). As the inadequacy of these means became apparent, the feeling arose that governments should aid. As early as 1850, France set up a voluntary unemployment insurance system. In 1880 England passed the Employers' Liability Act, from which workmen's compensation laws developed (*see* Employers' Liability). In 1883 Germany made accident insurance compulsory, and soon it added compulsory sickness insurance and old-age benefits. Compulsory unemployment insurance was first adopted by England, in 1911 (*see* Insurance).

Legislation in the United States

In the United States, with its tradition of individualism and its higher wage standards, social insurance was later in coming. Families and communities shared the burden of caring for distressed workers. Not until 1911 was the first workmen's compensation law enacted. Old-age benefits were offered by only a few unions and corporations, and the first government measure was enacted by Alaska in 1915 (*see* Pensions). Between 1923 and 1928 nine states passed laws permitting counties to give old-age pensions. In 1929 New York established a state system, and many states followed its example in the next few years.

A national system of social insurance was forced by the severe business depression that began in 1929. Private and community relief broke down under the vast load of unemployment, which reached some 13,000,000 by 1933. In 1935 Congress passed the Social Security Act. This empowered the Federal government to pay old-age benefits and to aid states to provide unemployment insurance. It also provided for aiding states to maintain public health services, to give vocational training to the physically disabled, and to help mothers, crippled children, and the needy blind. The act was amended and enlarged in 1939.

Taxes and Benefits

Unemployment insurance funds are provided by both state and federal taxes. The federal tax is 3 per cent of employers' pay rolls, but 90 per cent of it is offset against the state tax, usually 2.7 per cent, so that the total tax on employers is 3 per cent. In most states the rate is reduced for employers who have stabilized employment in their own business. Unemployed workers must accept any suitable work. If no job is open, the worker receives weekly payments after a "waiting period."

Old-age benefits are of two kinds, federal and state. Federal funds are provided by taxes on employers' pay rolls and on each employee's pay (up to $3,000 a year). Both taxes began at 1 per cent in 1937 and were to reach 3 per cent by 1949. A reserve fund is built up by investing the taxes in government bonds. Workers who retired in 1940 or after are eligible at 65 for monthly payments. Benefits are also paid to workers' wives (eligible at 65) and dependent children, and to widows. The amount depends on previous earned wages. The minimum total benefit is $10 a month; the maximum, $85. No *means test*—that is, proof that other income is lacking—is required. State old-age benefits are paid only to needy persons who were 65 before 1937. The Federal government contributes equally up to a total of $40 monthly.

Townsend Plan and Health Insurance

Higher old-age pensions than those provided in the Social Security Act have been advocated by many groups. A proposal which won a large following was the Townsend Plan, under which pensions of $200 a month would be provided for all unemployed persons over 60. President Roosevelt said such a system would cost 25 billion dollars a year.

Many favor some form of health insurance, also called sickness insurance, to provide medical care for persons in low-income groups. Under the compulsory systems that exist in many countries, funds for this purpose are created by fixed contributions from workers, employers, and usually the government. Under the voluntary systems in other countries, the state controls and contributes to mutual aid societies. Both these systems are sometimes called "socialized medicine," but the term strictly belongs only to the system operating in Soviet Russia, where all medical services are controlled by the state and are free to all the people.

In the United States, the Farm Security Administration in 1936 established an experimental program of medical and dental care for needy families in certain rural areas. Families contributed small monthly sums, usually from their FSA loans. In many places, group health insurance organizations have been formed without support of government funds. In these, fixed dues entitle members to a certain amount of medical, surgical, dental, or hospital service.

SOCIALISM. The name socialism has been applied to many different theories and plans for social reform. But in current writings and discussions it usually means a type of social organization under which land and other productive property are owned in common by all the people and are managed in their behalf by the state. A frequently used formula defines socialism as "the collective ownership and control of the means of production and exchange."

This means that the people as a whole would own and the state would control all farms, factories, stores, banks, insurance systems, power plants, and the facilities for transportation and communication. The list would include every kind of property classed as *natural resources* and *capital* (*see* Economics).

Social Aims Dominate Economics

It is essential, however, when studying these and similar aspects of socialism to bear in mind that the economic doctrines and theories of the movement are secondary considerations. The movement is primarily concerned with eliminating social causes of inequality among men, and its economic plans and regulations would be molded accordingly. Thus the common popular question about the amount and kind of personal property that would be left to an individual under socialism cannot be answered directly. He would have whatever might be deemed socially desirable. And, in any case, the property would be his solely by permission of the social group, and not because any *individual rights* to property were recognized.

Labor under Socialism

Among the inequalities that socialists propose to abolish are the conditions that permit some men to employ other men and to make a profit from their work. Under a socialist régime, labor either would be simple coöperation, as when two or more men work together on equal terms for their mutual benefit, or would be public labor in state-managed enterprises.

How would labor be divided among the people, and on what basis would the products of socialized industry be distributed? These questions have been answered in two principal ways. One doctrine is that each would get the kind of work suited to his ability and would be rewarded according to the *social worth* of his labor. Opposed to this is the communist formula, "From each according to his ability, to each according to his *needs*." Supporters of the first doctrine say that the opportunity to improve his condition is a necessary incentive to a man's best efforts. The communists reply that such an incentive breeds competition, rivalry, inequality, and discord. They say that when men have thoroughly learned the lesson of coöperation, they will no longer think of labor as something that calls for a measured reward, but will be content to receive no more than what they need for a secure and comfortable living.

Character of the Socialist "State"

The precise character of the socialist "state" is another subject of socialist controversy. Some have conceived it as a closely organized and centralized authority actively managing the economic life of a nation ("state socialism"). Others see it as a loose association of coöperative groups requiring no strong central authority when once economic competition and national rivalries have disappeared ("communism").

Socialist theories are further complicated for the student by sharp differences of opinion on the best methods for getting socialism established throughout the world. At one extreme are those who insist that it will require violent revolutions; at the other extreme are those who believe that socialism can be brought about by gradual changes in the present social and political régimes.

Origins of Socialism

Socialism, in its modern form, was born early in the period called the Industrial Revolution. Before the coming of the machine age, most of the poor were attached to the families, estates, or fighting forces of the property-owning classes (*see* Slavery and Serfdom; Feudalism). They were protected against outside enemies by their lords, and they usually got enough food to keep them from starving. They built their own homes and made their own clothes, and so possessed a certain low level of security.

When the Industrial Revolution shifted the economic center of gravity from the farm to the factory, it brought, not only new sources of wealth, but also more risks of poverty. The factory workers lacked the farm workers' assurance of food and shelter (*see* Industrial Revolution). Hence their problems grew more pressing. Out of these problems sprang the basic doctrines of socialism.

Early Socialists Called "Utopians"

Among the first to formulate these new social doctrines were the "utopians," so called by later socialists who considered their ideas to be as visionary as those in the famous book 'Utopia', written by Sir Thomas More in 1516 (*see* More, Sir Thomas). The chief "utopians" were the Count of Saint-Simon and Charles Fourier in France, and Robert Owen in Great Britain.

Saint-Simon (1760–1825) advocated a complete reorganization of industry and labor, under a dictatorship of scientists, technicians, and businessmen. Fourier (1772–1837) based his complex plans on a system of psychology which classified men according to temperament. He held that men of various types would work together harmoniously, if each had the job best suited to his nature.

Owen (1771–1858) began with experiments among the workers in the cotton mills which he owned in New Lanark, Scotland. He determined to prove that he could pay good wages and provide good working conditions, and still make money. For his 2,000 employes, he built a model community, including schools and coöperative stores. Encouraged by his success, he proposed the establishment throughout Great Britain of "villages of coöperation," where the poor could combine farming with industry, and exchange products among themselves. Meeting strong opposition to "Owenism" at home, he went to the United States and founded at New Harmony in southern Indiana a community based on the common ownership of property. Dissension among the leaders wrecked the experiment in four years. Back in England, Owen devoted himself to preaching his chief doctrine—that society is solely responsible for shaping character, and that it causes evil behavior when it encourages competition.

Although these early theories grew out of the Industrial Revolution, the men who preached them were remote from the immediate problems of the new industrial workers. The leaders of these workers speedily decided that the men would have to organize to force reforms. Most of these leaders turned eventually to trade-unionism (*see* Labor). To others this seemed a slow and uncertain road. They embraced some form or other of socialism and sought direct and immediate action.

In the first half of the 19th century, revolt was in the air. The French Revolution (1789–95) had shaken the political foundations of Europe, just as the Industrial Revolution had disturbed its economic foundations. Several countries underwent revolutions in 1830, and the ferment was working which was to bring on another series of revolutions in 1848. These uprisings were, in the main, democratic movements to obtain political freedom, but they encouraged dreams of social and economic revolt.

Karl Marx and Other Leaders

At this point appeared Karl Marx, whose doctrines of "scientific socialism" became the foundation of modern communism. The distinctive character of his theories and the part that communism has played in recent world history require that this phase of the socialist movement be given separate treatment (*see* Communism; Marx, Karl; Russia.)

Other socialist leaders, both before and after Marx, who were influential either through their writings or their political activity, were Louis Blanc (1811–82), the pioneer of political socialism in France; Ferdinand Lassalle (1825–64), organizer of social democracy in Germany; and Wilhelm Liebknecht (1826–1900) and Ferdinand Bebel (1840–1913), leaders of political socialism in Germany after Lassalle. England had few influential socialists. Characteristic of the movement there is the Fabian Society, formed in 1883, which advocated peaceful reform. Among its leaders were George Bernard Shaw, Sidney and Beatrice Webb, and Ramsay MacDonald. England also produced "Christian socialism" whose followers believed that socialism was a logical outgrowth of Christian doctrine.

Movements related to socialism, such as *anarchism* and *syndicalism*, are discussed in the article on Communism.

Socialism in the United States

About the middle of the 19th century, German political fugitives brought the socialist movement to the United States. They found little encouragement, because of the American tradition of individual initiative and private enterprise. In 1874 a workingmen's party was formed, which soon adopted the name of Socialist Labor party. In 1899 a branch of this split off to form the Socialist party. Among its best-known leaders were Eugene V. Debs, Victor L. Berger, Morris Hillquit, and Norman Thomas. Americans have played a small part in the international movement. (*See also* Labor Parties.)

Arguments Against Socialism

By directing public attention to evils in the existing social order, the socialist movement as a whole has been a far-reaching influence for reform. But there are many powerful arguments against a socialist form of society.

One of them is that socialism, by ending competition and by depriving men of the chance to accumulate wealth, would destroy two of the strongest incentives to self-improvement.

Another argument is that socialism would create a static civilization, since it would eliminate any kind of work that was not publicly recognized as socially valuable. This would block much of our progress, which so often depends on pioneering by individuals who are free to carry on their work despite public indifference or even hostility.

It is also said that self-government could not continue under socialism, because, with independent enterprise and competition eliminated, the very life of the people would depend on one factor—the efficient management of the socialist state. This in turn would depend on long-time planning and careful coördination by those in authority. Changes of administration in response to shifts in popular opinion would be impractical and dangerous to public security. Consequently the machinery of democratic rule would have to be abandoned in favor of some form of dictatorship.

In conclusion, it is pointed out that democratic nations operating under the profit system enjoy today the highest standard of living, the best wages, and the highest measure of social well-being to be found in the world. And these conditions are constantly undergoing further improvement. It is argued that all the benefits contemplated by socialism, without its drawbacks, are being gradually achieved by democratic methods within the existing political and economic framework of society.

SOCIAL SETTLEMENTS. Amid the grime of the slums in many a large city stands a friendly building called a social settlement. Day and night, hundreds of people from near-by tenements gather there for education and recreation.

Social settlements arose to relieve the distress brought about by the rise of crowded industrial centers (*see* Industrial Revolution). With the growth of factories, thousands of people poured into cities. Herded together in slums, they lived in filth and disease, too poor and too ignorant to better themselves. Unrest and crime flourished in these "blighted districts."

To help these people, a group of young graduates of Oxford University and Cambridge University determined to live and work with the poor in the East End of London. In 1884 they founded the first social settlement. This was Toynbee Hall, named for Arnold Toynbee, an Oxford economist, who had inspired the movement. Many other settlements have since been established in England and in other countries. The first in the United States was New York City's Neighborhood Guild, started in 1886 and later called the University Settlement. In 1889 Jane Addams and Ellen Gates Starr founded Hull House in Chicago (*see* Addams, Jane). Others included Henry Street Settlement in New York, South End House in Boston, and Telegraph Hill in San Francisco.

Most of the men and women who take up settlement work are college students or graduates. Many of them live in the settlement buildings, so that they can make friends with the people of the neighborhood and learn their problems at first hand.

Day and evening classes are held in English, citizenship, manual training, dressmaking, pottery, music, and many other subjects. For the children and young people, there are reading and game rooms, a gymnasium, a playground, and often a theater. There are clubs, too, for debating, dramatics, athletics, and civic activities. Many settlements also have day nurseries, employment bureaus, and child behavior clinics.

Social settlements have helped to bring about many social reforms. They aided labor organizations to get laws against sweat shops and child labor. Their pioneer work in training young people for trades and homemaking led many public school systems to provide similar opportunities. They have had a big part in fostering visiting nurse services, sanitary housing laws, slum clearance, and in bringing about the creation of the federal Children's Bureau.

STUDYING *the* VAST WEB *of* HUMAN SOCIETY

The Science that Surveys the Life of Man in Groups—How Groups Originate and What They Mean in Our Daily Lives—A New Way of Studying Old Facts that Contributes to both Knowledge and Progress

SOCIOLOGY. Suppose you decided to devote the rest of your life to helping other people. How would you go about it? One logical approach would be to find out as much as you could about the way the people in your community live. You would go into slums to study housing; into prisons to study crime; into schools to study education; into homes, churches, newspaper offices, and government buildings. Every place you went and every person you talked to would offer some new item of information, some additional facet in the many-sided life of your community.

Suppose now that you paused for a moment in your researches. What an amazing collection of data you have! Part of it is in the realm of psychology; part is history; part is political science. The word that applies to all the material you have is *sociology*. For this is the science of society as a whole. Its purpose is to study the behavior of people in their life together.

The objective study of sociology includes an investigation of human relationships, not only in their present form, but also as they arose in earliest times and evolved through the centuries. If you wished to "apply" your knowledge of sociology—that is, if you should go ahead with your plan of helping others—you might become a *social worker*. The function of the social worker is, through organized effort based on the principles of sociology, to aid in better adjusting people to their environment. Apart from general efforts for reform, social workers are active in such fields as poor relief, social settlements, pensions, and social insurance (*see* articles on those subjects). One of the earliest and most famous representatives of these tireless workers for the underprivileged was Jane Addams, the founder of Hull House, who inspired many others (*see* Addams, Jane).

What Society Means to Us

You may ask: Is not society too vague a field to be the subject of a special science? The answer is that society is a very real thing. Just think of trying to get along without parents, friends, teachers, team mates, business organization, or government, and you will find out that society is a very important factor in life. It seems vague only because you do not actually see it. Indeed, most great realities studied by science are invisible, such as electricity, gravitation, time, space, geometric points, atmospheric pressure, and energy. Just as gravitation is the invisible relationship between physical bodies, society is the invisible but ever-present relationship between human beings.

If you think deeply you will find that all reality in this whole immense universe is one. All the sciences study the same subject matter, but each picks out a special angle of reality and observes it carefully. Sociology does not pretend to tell everything about a human being. The chemist looks at him as a test tube full of interesting and complex chemical elements in action. The physicist sees him as a mass of matter in motion; the psychologist, as a center of brain, nerve, and mind; the economist, as a producer and consumer of wealth. The sociologist is interested in human beings in groups, living together, working together, fighting, worshiping, playing, celebrating, and doing all manner of things in concert, that is, in associated living or community life.

What Makes a Society?

How can you recognize a genuine society? All real societies are distinguished from mere accidental or temporary groups by three or four characteristics. First is the impulse to get together. Normal people love company; they avoid being alone. A second mark is some common bond of sentiment or feeling. People of similar tastes, interests, or experiences tend to come together. If they thrill over the same experience or are loyal to the same flag or religion, they want to strengthen those feelings by associating with others of like mind. A third characteristic is mutual or reciprocal service.

The first two characteristics might bring people together into temporary groups but they might not hold them permanently. If, however, people discover ways in which they can exchange services that will make it possible for all to fare better, they are likely to remain together. This "division of labor" or social interdependence is the starting point of economic organization. In fact, Plato considered it the real basis of all human society. Some sociologists would add the ability to perpetuate itself as a fourth mark of a genuine society. If we accept this we would accept as genuine societies a state, a city, a family, or a tribe; but we would deny that name to such groups as business partnerships, gangs, and perhaps even churches or fraternal orders. It is better, however, not to narrow too closely the idea of society; wherever we have the first three of these characteristics we have community, and that is society.

It is clear, then, that sociology tries to find out what are the common essentials of all group life. It wants to know how groups are formed, how they are maintained, what they do, and how they change. It is also clear that although some societies can be made to order, most are formed naturally. We make comparatively few societies for ourselves. We are born into or drift unconsciously into most of them: for example, our country, our family, our neighborhood, our political party, and even our church. Hence society is not a *contract*, as the French philosopher Rousseau thought, but a web of human *contacts*.

You can prove this for yourself. Suppose you take a piece of paper and make a little circle in the center of it to represent yourself. Then make a dot for every person or institution you touch in any way during a day or so. Next, draw lines connecting these dots, showing the relationships between them. You will find yourself caught, as it were, in a veritable spider web of social relationships involving yourself, your parents, teachers, tradesmen, and friends, perhaps even the police and fire departments.

You can prove the same thing in another way. Make a simple map of your neighborhood; put down not only all its physical features, but also every house, school, shop, church, recreation center, and other places of interest. Draw lines to show the routes people take between these places, and you will get a picture not only of common interests and the desire to get together, but also of common service.

Study of Group Activities

These pictures bring out the fact that we can gain an understanding of a thing only by observing what it does. If we want to understand human society, we must know what human groups do. We must study characteristic group activities, such as getting a living, mating, worshiping, discovering, fighting, playing, and "showing off." Sociology finds that the essential problem is: How are individuals brought to do these various things together? Consequently we have to study the rules of the game, as seen, for example, in customs, laws, institutions, tabus, and ceremonies. We want to know how these rules started, why they change and develop, and why they sometimes fade out.

We learn that some peoples have customs and laws so different from our own as to appear odd, grotesque, barbarous, shocking, or worse. Why, for example, should boys of Australian native tribes have their teeth painfully filed down to sharp points during their initiation into tribal membership? Why should some African peoples think it beautiful to bore holes in their lips and insert thick sticks to make the lips broad and sagging? Why should tribesmen of Borneo find head-hunting their greatest joy in life? Why should other tribes practise cannibalism?

It is the business of sociology to study such group behavior even if it seems unpleasant. Even among our own people there are many irrational beliefs which we call "superstitions" (*see* Magic). These, too, must be studied and explained. The sociologist must not overlook fads and fashions, for they show, perhaps more than anything else, the effect that living together, watching one another, trying to imitate one another, has on human beings. This "following the leader," this desire to be like-minded, is a fundamental fact in the science of society.

In spite of all desire to the contrary, disagreements are bound to occur in and between human groups. The causes of these disagreements, and the characteristic ways in which they are either fought out, or smoothed over, form another topic of sociology. This includes such subjects as war, criminal laws, arbitration, slavery, and class consciousness. Closely connected with the latter is the idea of social control, that is, how government, religion, the schools, family discipline, and public opinion, all combine to restrain individuals and make them fit into certain molds and conform to certain rules of approved conduct.

The sum of all these rules, characteristic activities, and methods of group life is frequently called human *culture*. In other words, human group behavior is ultimately human culture. Thus, sociology might be thought of as the comparative study of human cultures. Since the first principle of this science, as with all other sciences, is to ascertain the facts, it must be wide in its sympathies and in its tolerance. It cannot hope to understand Chinese or Hindu or Polynesian societies if it regards those cultures as merely humorous or queer. The rock-bottom conclusion of sociology is that mankind the world over is biologically a unit; there are differences only in culture, that is, in beliefs, customs, and ways of doing things.

Since these beliefs, customs, and ways of doing things among human beings are accompanied by ways of preserving and transmitting them, we have here a mark which distinguishes human societies and humanity in general from all lower forms of organization and life. It is true that ants, bees, and some of the other lower orders of life have marvelous social organizations. But we cannot discover that they have any way of handing on this organization except by physical inheritance. They have instinct and heredity, but no history. Human societies are heirs to history. Their culture stretches back thousands of years and reaches into the future because of such human inventions and discoveries as language, writing, painting, sculpture, schools, and libraries, which make it possible to accumulate knowledge and pass it on.

Change and Progress

Perhaps the most outstanding fact of life is change. Human society always has been and always will be changing. The body structure of early types of man is very different from that of men today. Remains of their implements and works of art vary widely from our own. Sociology studies these changes and tries to explain them. It may be that society merely changes; it may be that it evolves along some certain line; it may be that this change is in the general direction of improvement. In the last case it is called social progress, and sociologists try to find out its nature and causes.

Culture, or group behavior, assumes certain fixed forms, just as an individual forms habits. These habitual ways of thinking about and doing things in groups are called *institutions*. A social institution is a group custom, such as marriage, property, education, government, or religion. These institutions are relatively constant. They are the result of much experimentation as to the best way of avoiding trouble and securing peace and happiness. But since new situations are constantly occurring, institutions have

to adapt themselves to meet these changes. Modern industrialism, for example, has caused profound institutional changes.

Physical science tells us that "nature abhors a vacuum." Since society is part of nature, it follows that social processes do not go on in a vacuum or on an empty stage. Men live on the earth and are to a great extent dependent upon the earth for food, shelter, raw materials, and recreation. This relationship between man and his physical environment is sometimes called *anthropo-geography* and includes such problems as the effect of climate, topography, and natural products.

In a sense, the social history of mankind is the story of how man has gradually freed himself from the domination of his environment and has instead learned to use it for his own purposes. Steps in this progress have been the discovery of fire, the invention of pottery, domestication of animals, agriculture, smelting of metals, and the development of transportation and communication (*see* Civilization).

Relationship to Other Sciences

One of the most obvious facts about mankind is the separation of peoples into different races (*see* Races of Mankind). The physical aspect of human races is primarily the study of biology and anthropology. But since differences of skin coloring, head form, or texture of hair cause people to think, believe, and act in characteristic ways, sociology has to take these physical aspects into account. *Social anthropology*, *ethnology*, and *ethnography* are terms used to indicate branches of science which study the factor of race in human culture.

Sociology is linked with biology, economics, and other sciences in the study of *vital statistics;* that is, fluctuations in the population, such as birth rate, marriage rate, death rate, and immigration (*see* Biometry). Some sociologists consider these facts to be the very core of the science of society, for they form the connecting links between human beliefs, human heredity, and the physical environment.

Sociology appears then in a double capacity. It is a general study of the group as a whole, and in all its phases, in the effort to understand the nature of community life. Because of this it forms a background for the specialized social sciences, such as economics, political science, ethics, and, to a certain extent, history. It is not an overstatement to claim that sociology is the basic social science.

Since the object of science is not simply knowledge for the sake of knowledge, sociology must formulate social problems and apply its knowledge to their solution. Thus, *applied sociology* is concerned with such diverse problems as crime, poverty, war, ignorance, industrial maladjustment and conflict, immigration, race prejudice, leisure, and eugenics.

Sociology uses the results of psychology to describe the operations of the human mind. It depends upon history for many records of past social groups and also for special methods of studying those records. Archeology aids sociology by uncovering the story of peoples and their ways of living thousands and even tens of thousands of years before any written record had been invented.

A New Way of Studying Old Facts

Although sociology is sometimes thought of as the youngest of the social sciences, its subject matter is as old as man himself. For many centuries thinking men have speculated upon social problems, the nature of man, and the origin and workings of human society. Plato and other Greeks caught glimpses of many essential ideas which have become prominent in modern social science, for example, division of labor, eugenics, and social control through education. The Hebrew prophets, particularly Amos, proclaimed a better social order. St. Paul clearly taught through his concept of the mystic body, or union of Christian believers, that society is a reality. Here and there through the centuries an occasional thinker like Sir Thomas More and Thomas Hobbes delved deeply into the nature of society and social man.

It was not until the 18th century that scholars in England, France, Germany, and Italy came close to what we think of as social *science*. Some attention was given to the effect of climate and geography upon society, but for the most part the discussions went little beyond what we call the philosophy of history. The French Revolution, the Industrial Revolution, new discoveries in physics, chemistry, and biology, and later Darwin's theory of evolution gave great impetus to social studies.

Some Famous Sociologists

Toward the middle of the 19th century the French philosopher, Auguste Comte, applied the name sociology to what he conceived as the topmost rung of the scientific ladder. Herbert Spencer, John Stuart Mill, L. T. Hobhouse, and Edward A. Westermarck in England; Durkheim and Tarde in France; Schäffle in Germany; Ward, Sumner, Giddings, and Ross in America, are among the men who have contributed most largely to building up the science of sociology. It is now taught in most American colleges and in representative universities all over the world.

It is too early for such a new and comprehensive science to assume its final form, or to produce any remarkable principles or remedies which might be applied at once to counteract social evils. The subject matter of sociology is the most complex covered by any of the sciences. New methods of investigation have to be worked out to deal with such social phenomena as mob mind, imitation, spread of culture, fluctuation in birth rate, suicide, and social change.

Nevertheless, sociology has already exerted an appreciable effect upon economics, history, law, political science, ethics, education, and religion. It has established certain facts which may be of great value in the creating of a better social order. While its first aim remains to know the facts about social life, its great service will be, as Comte taught, to promote human progress and a more rational society.

REFERENCE-OUTLINE *for* SOCIOLOGY *and* GENERAL SOCIAL SCIENCE

THE following outline is designed to include not only the topics usually grouped under the name of sociology but also those that form the links with the other social sciences such as history, social geography, economics, political science, education, and the like. The sections on man, food, clothing, and shelter provide the most practical approach to the more complex social problems.

Man and His Needs

I. THE NATURE OF MAN:
A. His Origin and Antiquity: M-45–6.
B. Influence of Heredity: H-283, E-342.
C. Influence of Environment: H-286, E-342, L-79.
D. Man's Social Nature: S-182.
 a. His Social Heritage: E-163.
 b. Coöperation an Economic Necessity: E-146.
E. Biometry: B-118.

II. FOOD:
A. The Influence of the Necessity for Food:
 a. On Man's Place of Settlement: F-141, F-142, M-167, M-48.
 b. On Man's Tendency to Live with His Fellow Man: F-140, S-111.
 c. On Man's Peaceful or Warlike Life: F-141, F-142.
 d. On Man's Inventive Genius: F-143, A-49.
B. Man's Struggle for Food:
 a. Primitive Man Took Food as He Found It: F-140–1, M-47.
 b. The Beginnings of Agriculture: A-47, C-244, M-48.
 c. Food Production in Medieval Times: A-59.
 d. Food Production in Modern Times: F-143, A-48–58.
C. The Story Behind Our Chief Foods:
 a. Grain: Barley B-46–7; Buckwheat B-258; Corn C-366–9; Kafir K-1; Millet M-176; Oats O-191; Rice R-101–3; Rye R-202; Wheat W-82–4.
 b. Vegetables: G-13. Asparagus A-336; Bean B-65; Beet B-79; Cabbage C-1; Carrot C-87; Cauliflower C-1; Celery C-121; Cucumber C-413; Lentil L-98; Lettuce V-312; Onion O-225; Pea P-90; Potato P-324; Pumpkin P-366; Radish C-1; Rutabaga C-2; Squash S-265; Sweet Potato S-341; Tomato T-106; Turnip C-2.
 c. Fruit: F-211–14. Apple A-231–2; Apricot A-233; Banana B-36–8; Blackberry B-152; Blueberry B-159; Cherry C-182; Cranberry C-391; Elderberry E-213; Gooseberry G-120; Grape G-135–6; Grapefruit G-133–4; Lemon L-93–4; Mango M-51; Melon M-111–12; Mulberry M-297–8; Orange O-238–40; Peach P-93; Pear P-95; Pineapple P-221; Plum P-260; Raspberry R-51; Strawberry S-306.
 d. Nuts: N-187. Almond A-133–4; Butternut B-286; Chestnut C-184–5; Chinquapin C-222; Coconut C-292–4; Hazel H-253; Hickory H-289–91; Peanut P-94–5; Pecan P-99–100; Walnut W-5–6.
 e. Fishery Produce: F-74–5, F-76–8, F-78–82. Clam C-258; Crab C-388; Crawfish C-391; Frog F-207; Lobster L-175; Octopus C-417; Oyster O-262; Scallop S-35; Sea-Cucumber S-67; Shrimp S-135; Terrapin T-167; Turtle T-166.
 f. Meat: M-96–101. Cattle C-101–15; Hogs H-316; Sheep S-104–6; Stock Yards M-96–7.
 —Poultry P-336; Duck D-116; Goose G-119; Guinea-Fowl G-183; Turkey T-158; Eggs E-192.
 g. Dairy Produce: D-1–5. Butter B-281–2; Buttermilk M-173; Cheese C-164–5; Evaporated and Condensed Milk M-173; Oleomargarine O-221–3.
 h. Beverages: Milk M-172–3; Chocolate and Cocoa C-223, C-292, C-10; Coffee C-294; Tea T-21.
 i. Spices and Condiments: S-249. Salt S-15; Sugar S-319; Pepper P-119; Vanilla V-273; Cloves C-282; Mustard M-325; Ginger G-88; Nutmeg and Mace N-186.
D. Preservation of Foods: A-223. Canning C-73–5; Cold Storage C-299; Dehydration D-38; Refrigeration R-67–70; Salting S-15.
E. Food as a Body and Health Builder: F-144–6.

III. CLOTHING:
A. The Purpose of Clothing: C-276.
B. The History of Clothing:
 a. Primitive Clothing: C-275–6.
 b. Egyptian and Babylonian Costume: D-106.
 c. Greek and Roman Costume: D-106, D-107 pictures.
 d. Clothing in the Middle Ages: C-276, D-108 pictures.
 e. Development of Modern Costume: D-106–9.
  1. Clothing of the 18th and 19th Centuries D-109.
  2. American Colonial Dress A-172, P-264 and P-265 pictures.
  3. Fashions—Their Beginning and Influence C-276.
C. Why People Have a National Costume: C-275.
D. Modes of Dress the World Around: (All references are to pictures).
 a. Temperate Climate: American Indian I-52, I-53, I-54, I-56, I-57, I-60, I-61, I-62, I-64, I-65, I-68; Austria A-382; Belgium B-89; Bulgaria B-270; China C-209, C-215–20, C-221e; France F-171, F-175, F-176, F-178; Germany G-74; Greece G-163; Ireland I-124; Italy I-154, I-158, I-159, I-161; Japan J-187, J-189, J-191*a*, J-192; Java J-205; Netherlands N-67, N-68, Norway N-172, N-175, N-177; Persia P-130, P-131; Poland P-276, P-278; Portugal P-313; Rumania R-174, R-176; Russia R-179, R-181, R-183, R-190, R-192, R-193; Scotland S-44; Spain S-225, S-226, S-231; Sweden S-336, S-337; Switzerland S-349; Turkey T-160, T-161, T-163; Yugoslavia Y-212.
 b. Warm and Hot Climate: Africa A-32, A-34, A-35, A-36, A-37, A-39, A-40, A-41, A-43; Arabia A-238, A-239, A-240, A-241; Borneo B-196, B-197, B-198; East Africa E-138; South Africa S-200, S-203; India I-33, I-34, I-36, I-37, I-38; Mexico M-133, M-134, M-135; Philippines P-165, P-166; Siam S-136, S-137; South America S-207.
 c. Cold Climate: Greenland G-175; Iceland I-5, I-6; the Eskimos E-302, E-303; Polar Regions P-281, P-282.
E. Our Clothing Comes from the Ends of the Earth: C-273–6.
F. The Story Behind Our Chief Clothing Materials:
 a. Plant: Cotton C-274, C-375–82; Flax F-105–6; Rayon R-53–5; Rubber R-163–70.
 b. Animal: Feathers F-20; Felt F-23; Fur F-223–8, T-127–9; Leather L-83–7; Silk C-273, C-274, S-144–50; Wool W-140–5, S-104–6.
G. The Story Behind Our Chief Clothing Products:
 a. Manufacturing Processes: Bleaching B-155; Dyeing C-274, D-121–2; Knitting K-31–3; Sewing S-87–94; Spinning and Weaving S-258–9; Teazeling W-145, W-144 picture.
 b. Finished Products: Cloth T-69–71; Clothing C-277–9; Gloves G-106–7; Hats and Caps C-275, H-235–7; Shoes S-130–3; Buttons B-286; Lace L-47.
H. Enhancing Beauty Through Well-Chosen Dress: D-110–13 and pictures.
I. Care of Clothing: Laundering and Dry Cleaning L-71.
Note: *See also* the Reference-Outline for Home Economics.

IV. SHELTER:
A. Meaning of the Word "Shelter": S-110.
B. Primitive Shelter:
 a. Nestlike Huts in Trees: S-110, N-84 picture.
 b. Cliff Dwellings: C-269–70, A-291 picture.
 c. Cave Dwellings: C-118–19.
 d. Crude Huts: S-110–11, A-40 and A-326 pictures.
 e. Lake Dwellings: S-111, M-48, L-55, M-47 picture.

C. Shelter of Early Civilizations:
  a. The First Houses Appeared in Mesopotamia and Egypt: S-111 and picture. Use of Brick and Tile B-236 and picture.
  b. Early Greek and Roman Houses: S-111-12. Pompeii P-299-300.
  c. Early European Dwellings: S-112.

D. Shelter in the Middle Ages:
  a. The House, the Center of All Activity: S-113.
  b. The Castle: C-92-4, I-127 picture, A-380 picture, J-220 picture.
  c. Shelter in Feudal Times: S-112.

E. Shelter in Modern Times:
  a. Difference Between "Shelter" and Architecture: A-257. (*See* Reference-Outline for Architecture.)
  b. American Indian Shelter: S-111, S-113, I-59-60. —Indians of Eastern Woodlands I-53 picture; Plains Indians I-54 picture; Hopi Indians I-55 picture; California Indians I-56 picture; Iroquois I-59 picture; Blackfeet Indians I-60 picture; Apache Indians I-60 picture; Creek Indians I-61 picture; Navajo Indians A-292 picture; Pueblos P-365; Incas I-27 picture.
  c. American Pioneer and Colonial Dwellings: S-113, A-167-8 and pictures, A-169 picture, A-155 picture, A-162 pictures.
  d. Types of Shelter in Distant Countries:
    1. Temperate Climate—Austria A-382 picture; Belgium B-86; China C-210, C-212, C-214-15, C-216, C-218, C-221*g-h*; England E-275; Germany G-65 picture; Hungary H-361 picture; Ireland I-126 picture; Japan S-113-14, A-327 picture; Netherlands N-66 and N-70 picture; Nomadic Peoples S-111, A-239 and A-37 and G-91 pictures; Norway N-175 picture; Portugal P-315 picture; Russia R-181 picture; Switzerland S-350 picture.
    2. Warm and Hot Climate—Africa A-40 picture; India I-31 and H-292 pictures; Malay Peninsula M-42 picture; Palestine J-211 picture; Panama P-39 picture; Philippines P-166 picture; Samoa P-7 picture; Siam S-137 picture; South Africa S-200 picture.
    3. Cold Climate—Eskimos S-111, S-112 picture, E-301 picture; Siberia S-112 picture, S-138 picture.

F. Shelter Problems of the Modern World: S-114.

Social Progress or the Growth of Civilization

I. PRIMITIVE ISOLATION:
A. Independent Struggle Against Nature: C-244.
B. Unsettled Life: M-47.

II. BEGINNINGS OF SOCIAL OR GROUP LIFE:
A. The Foundation of the Home: M-48.
  a. Influences that Made Settled Homes Possible:
    1. The Discovery of the Use of Fire F-45, M-47, C-244 picture.
    2. Invention of Weapons for Hunting and Defense—Stone Weapons M-47; Bow and Arrow A-254, C-244.
    3. Invention of Pottery M-48, C-244 picture.
  b. Division of Labor: Men as Hunters and Warriors, Women as Home Managers M-48, F-8-9.
  c. Types of Primitive Homes: Cave Dwellers C-118; Lake Dwellers L-55, M-48, S-111 picture.
B. Influence of Settled Homes:
  a. Neighbors Unite for Mutual Aid and Protection: S-182.
  b. The Rise of Simple Arts and Crafts: C-118-20.
    1. The Stone Age, Comprising the Paleolithic, Mesolithic, and Neolithic Ages S-292, M-47.
    2. Education by Word of Mouth (Tradition) E-165.
  c. Agriculture Becomes Possible: C-244, A-47, S-111.
  d. The Domestication of Animals: C-244, C-101.
C. Influence of Agriculture and Domestic Animals:
  a. Accumulation of Surplus Food: C-101.
  b. Division of Labor Outside the Home: Nomadic Herdsmen, Settled Farmers, and Independent Craftsmen E-166, M-48, A-47.
  c. The Beginnings of Commerce: A-47, C-245.
D. Effects of Commerce: C-322.
  a. The Rise of Cities: C-242, C-245.
    1. As Market Places (Fairs) F-3.
    2. As Dwelling Places of Craftsmen G-87, E-166.
  b. The Development of Transportation:
    1. Beasts of Burden, Wagons, and Other Vehicles T-121, C-101.
    2. Establishment of Trade Routes C-322.
    3. Boats, Ships, and Navigation B-161, S-117, N-46.
  c. The Rise of Class Distinctions: G-125.
    1. Slavery and Serfdom S-158.
    2. The Caste System I-36.
  d. Need for Political Organization Arises: G-125.
E. Results of Political Organization:
  a. It Requires Written Decrees and Records: C-245. —Invention of Writing W-184, E-164.
  b. The Development of Formal Law: L-74.
  c. The Beginning of Formal Education: E-165-6.
  d. The Growth of Nations and National or Race Spirit: G-125.
  —Many Begin as City-States C-242.

III. THE RISE OF GREAT NATIONS AND PEOPLES:
A. Geographical Influences: C-245.
  a. Favorable Soil and Climate: Mesopotamia M-120; Egypt E-194; China C-211-14; India I-34.
  b. Harbors and Trade Routes: Greeks G-153; Phoenicians P-173.
B. Racial Influences:
  a. Migrations of Vigorous Peoples into More Favorable Environment: M-167. Romans R-128.
  b. Military Enterprise and Leadership: Rome R-134; Macedonians Under Alexander A-113.
C. Religious Influences:
  a. The Jews Invigorated by Their Faith: J-217.
  b. Christianity Teaching Coöperation and the Conversion of Unbelievers: C-233, J-213.
  c. Mohammedanism Inspiring Its Followers to Conquest: M-213.

Note: For a detailed study of the social influences that contributed to the rise and development of each of the great nations of antiquity consult the Reference-Outline for Ancient History. For a similar study of any modern nation, consult the Reference-Outline with the article on that nation.

D. Conflicts and Wars Between Nations:
  a. Causes of Conflict:
    1. Economic Rivalry for Territory (Resources) and Commerce—Hundred Years' War H-357; the English-Dutch Wars for East Indian and Other Trade N-72, E-142.
    2. Religious Differences E-323.
    3. Ambitious Leaders—Napoleon N-5.
  b. Social Results of Settling Disputes by Warfare:
    1. Exaltation of Military Power (Militarism) and Increase of Armaments P-91, A-306.
    2. Distrust Between Nations and Peoples P-91.
  c. Efforts to Settle International Disputes by Peaceful Methods: P-91. Arbitration A-246; Treaties T-129; International Law I-108.
E. Internal Social Conflicts:
  a. Political:
    1. Oppressed Groups Seek Independence—Switzerland S-350; American Colonies R-81.
    2. Seek Change in Form of Government—French Revolution F-200; Russian Revolution R-188.
  b. Economic:
  —Class Struggle—Labor Movement L-43.

IV. SOCIAL INFLUENCE OF INVENTIONS: I-113.
A. Gunpowder Gives Fighting Power to the Common Man: G-188.
B. The Magnetic Compass Extends Navigation: C-326.
  a. Leads to Discovery and Settlement of New Lands: A-142.
  b. Adds to Civilization's Store of Raw Materials: E-343.
  c. Increases Contacts Between Peoples: C-247.
C. Invention of Printing Makes General Education Possible: P-346, E-164.
D. The Steam Engine Ushers in the Industrial Revolution: I-74*d*, S-280.
E. Extension of the Use of Machinery: M-10.
F. Development of Electric Power: E-215, E-233.
G. Social Significance of Power Development: P-339, L-93.
V. THE SPREAD OF DEMOCRACY: D-45.
VI. MODERN CIVILIZATION AN INTERNATIONAL COMMONWEALTH: C-247-8.

Social Institutions and Group Activities

I. THE FAMILY:
A. The Clan, the Tribe, and Other Family Groups: F-8-12.
B. Marriage and Marriage Customs: M-68.
  a. Monogamy, Polygamy, and Polyandry: F-8.
  b. Divorce: M-68.
C. Social Necessity of Family Unit:
  a. The Child and His Physical Needs: C-197. Baby Care B-1.
  b. Early Training Determines Habits and Character: H-193, C-140.
  c. Safety: S-2.
II. THE SCHOOL: S-40. Schools (ranging from nursery schools to universities) are social institutions maintained by private groups and organizations or by the state. A complete survey of their history and organization will be found in the Reference-Outline for Education.
III. CHURCHES: C-233, R-71.
IV. THE GOVERNMENT: G-124. The various forms and branches of government, their organization and history, are surveyed in the Reference-Outline for Political Science.
V. PUBLICITY:
A. Newspapers: N-104.
B. Advertising and Propaganda: A-23.
VI. SOCIAL WELFARE WORK:
A. For Children: P-162. Child Labor Laws C-205; Juvenile Courts J-232.
B. For Mothers: Mothers' Pensions P-161.
C. For the Poor and Disabled: Pensions P-118; Education of the Blind B-156; Education of the Deaf D-22; Poor Relief P-302; Employers' Liability E-263; the Salvation Army S-19.
D. For Delinquents: Prisons and Punishments P-348.
E. For Victims of Disasters: The Red Cross R-59.
F. For Immigrants: Americanization A-175.
  —Immigration as a Social Problem—The Story of Mary Antin: I-25.
G. The Negro Problem in the United States: N-62.
  —The Work of Booker T. Washington: W-12.
H. Social Settlements: S-181.
  —Jane Addams and Hull House: A-17.
I. Philanthropy: P-160.
  —Some Famous Social Service Workers: Florence Nightingale N-145; Clara Barton B-52; Wilfred Grenfell G-177.
VII. OTHER SOCIAL ORGANIZATIONS:
A. Patriotic Societies: P-89, A-176.
B. Fraternal Groups: F-193, K-31.
C. For Young People: Young Men's Christian Association Y-208; Young Women's Christian Association Y-209; Boy Scouts B-213; Girl Scouts G-93; Camp Fire Girls C-40.
D. Women's Clubs: W-131.
E. Parent-Teacher Associations: P-70.
Note: For gilds, coöperative societies, and labor organizations, consult the Reference-Outline for Economics.

Social Beliefs and Customs

I. MAGIC AND WITCHCRAFT: M-29, W-127.
II. MYTHOLOGY: M-326.
III. FOLK-LORE: F-132, S-303 *a-p*.
IV. ETHICS: E-306.
V. COSTUME AND ADORNMENT: D-106.
A. Gems and Jewelry: G-25.
B. Tattooing: T-16.
C. Armor: A-304, K-29.
D. Uniforms: U-177.
VI. SOCIAL RANK AND PRECEDENCE:
A. Decorations and Titles of Honor: D-31.
B. Etiquette: E-310.
VII. ORIGIN OF PERSONAL NAMES: N-2.
VIII. HOLIDAYS AND FESTIVALS: H-319.
IX. AMUSEMENTS: H-313.
A. Group Games for Young Children: P-247.
B. Athletic Games: Baseball B-53; Football F-148; Basketball B-59; Hockey H-314; Rowing B-163; Tennis T-49; Lacrosse L-52; Bowling B-207; Curling C-414; Cricket C-395; Golf G-116; Fencing F-23; Polo P-297; Water Polo P-297; Boxing B-208; Wrsstling W-181.
C. Sports: Swimming S-345; Skating, Skiing, Snowshoeing, and Sledding W-115; Boating and Canoeing B-161, C-75.
D. Non-Athletic Games: Chess C-182; Checkers C-163; Billiards B-108; Croquet and Roque C-402; Playing Cards C-83.
E. Theatrical Entertainment: T-74. Motion Pictures M-273.

Bibliography for Social Science

Food, Clothing, and Shelter

—Books for Younger Readers:

Bachman, F. P. Great Inventors and Their Inventions (Amer. Bk. Co., 1941).
Baity, E. C. Man Is a Weaver (Viking, 1942).
Carpenter, F. G. How the World Is Clothed (Amer. Bk. Co., 1929).
Carpenter, F. G. How the World Is Fed (Amer. Bk. Co., 1928).
Carpenter, F. G. How the World Is Housed (Amer. Bk. Co., 1930).
Eaton, Jeanette. Behind the Show Window (Harcourt, 1935).
Hartman, Gertrude. Machines and the Men Who Made the World of Industry (Macmillan, 1939).
Hough, W. R. Story of Fire (Doubleday, 1928).
Lamprey, Louise. The Story of Cookery (Stokes, 1940).
Leeming, Joseph. Costume Book (Stokes, 1938).
Petersham, M. F. and Mieka. Story Book of Things We Use (Winston, 1933).
Webster, H. H. and Polkinghorne, A. R. What the World Eats (Houghton, 1938).

—Books for Advanced Students and Teachers:

Burlingame, Roger. March of the Iron Men (Scribner, 1938).
DeKruif, P. H. Hunger Fighters (Harcourt, 1928).
Evans, Mary. Costume Throughout the Ages (Lippincott, 1938).
Gamble, M. T. and Porter, M. C. To Market, to Market (Bobbs, 1940).
Huntington, Ellsworth and Cushing, S. W. Principles of Human Geography (Wiley, 1940).
Luckiesh, Matthew. Torch of Civilization (Putnam, 1940).
Reed, W. V. and Ogg, Elizabeth. New Homes for Old (Foreign Policy, 1940).
Reich, Edward and Siegler, C. J. Consumer Goods (Amer. Bk. Co., 1937).

(For other aspects of Social Science, *see also* such bibliographies as Architecture, Communication, Conservation, Economics, Etiquette, Industries and Industrial Arts, and Industrial Revolution.)

Sociology

Addams, Jane. Twenty Years at Hull House (Macmillan, 1910).
Addams, Jane. Second Twenty Years at Hull House (Macmillan, 1930).
Barnes, H. E. and Ruedi, O. The American Way of Life (Prentice-Hall, 1942).

Barnes, H. E. Social Institutions in an Era of World Upheaval (Prentice-Hall, 1942).
Bogardus, E. S. Development of Social Thought (Longmans, 1940).
Bossard, J. H. S. Social Change and Social Problems (Harper, 1938).
Brainard, D. S. and Zeleny, L. D. Probleme of Our Times, 3v. (McGraw, 1937).
Brawley, B. G. Short History of the American Negro (Macmillan, 1939).
Corsi, Edward. In the Shadow of Liberty (Macmillan, 1935).
Davie, M. R. World Immigration (Macmillan, 1936).
Fairchild, H. P. Immigration (Macmillan, 1933).
Fink, Arthur. Field of Social Work (Holt, 1942).
Fish, C. R. Rise of the Common Man (Macmillan, 1927).
Furnas, J. C. and others. How America Lives (Holt, 1941).
Gavian, R. M. W. and others. Our Changing Social Order (Heath, 1941).
Glueck, Sheldon and Eleanor, eds. Preventing Crime (McGraw, 1936).
Groves, E. R. The American Woman (Greenberg, 1937).
Guide for the Study of American Social Problems; comp. for the American Social Problems Study Commission. (Columbia Univ. Press, 1942).
Hartman, Gertrude. The World We Live In (Macmillan, 1931).
Kurtz, R. H., ed. The Social Work Yearbook, 1943 (Russell Sage Foundation, 1943).
Landis, P. H. Our Changing Society (Ginn, 1942).
Lynd, R. S. and H. M. Middletown (Harcourt, 1930).
Lynd, R. S. and H. M. Middletown in Transition (Harcourt, 1937).
Mangold, G. B. Problems of Child Welfare (Macmillan, 1936).
Marshall, L. C. Story of Human Progress (Macmillan, 1925).
Morgan, A. E. The Small Community (Harper, 1942).
Neurath, Otto. Modern Man in the Making (Knopf, 1939).
Odum, H. W. American Social Problems (Holt, 1939).
Ottley, Roi. New World A-Coming (Houghton, 1943).
Overstreet, H. A. We Move in New Directions (Norton, 1933).
Pegg, C. H. and others. American Society and the Changing World (Crofts, 1942).
President's Research Committee on Social Trends. Recent Social Trends in the United States (McGraw, 1933).
Reid, M. G. Consumers and the Market (Crofts, 1942).
Sait, U. M. New Horizons for the Family (Macmillan, 1938).
Smith, T. L. The Sociology of Rural Life (Harper, 1940).
Sumner, W. G. Folkways (Ginn, 1940).
Taft, D. R. Criminology (Macmillan, 1942).
Wald, L. D. Windows on Henry Street (Little, 1934).
Warner, W. L. and Lunt, P. S. Social Life of a Modern Community (Yale Univ. Press, 1942).

SOCRATES (*sŏk'rȧ-tēz*) (about 469–399 B.C.). The most familiar figure on the streets of Athens near the end of the fifth century B.C. was an awkward man, with a squat figure, a short neck, a bald head, a thick upturned nose, round prominent eyes—the very picture of an old satyr. He wore a single rough woolen garment at all seasons, and went barefoot.

Now and then he would stop some richly dressed solemn Athenian and ask him a simple question or two. The man would perhaps reply with an air of haughty wisdom, as if it were really beneath his dignity to hold discussion with so uncouth a questioner. But presently as a crowd gathered, the rich Athenian would discover that his grotesque adversary was making him seem absurd by his shrewd queries, and would depart in high anger.

The barefooted speaker was the great Socrates, the wisest philosopher of his time, whose words changed the whole course of human thought, and who today is ranked as one of the greatest moral teachers that ever lived. Despite his appearance, even the beauty-loving Greeks of his day could not resist the fascination of his speech. That young and aristocratic military genius Alcibiades said of him, "His nature is so beautiful, golden, divine, and wonderful within that everything he commands surely ought to be obeyed even like the voice of a god."

Socrates was born in the outskirts of Athens in 469 B.C. He studied sculpture, his father's profession, but soon abandoned this work to "seek truth" in his own way. His habits were so frugal and his constitution so hardy that he needed only the bare necessities of life, and he was free to devote his time to other things than making money.

Socrates did not know the meaning of fatigue. Once the word passed around that he had been standing in one spot since early morning thinking on some deep problem. The people gathered about to see how long he would remain there. But they had to bring out their beds to rest, for Socrates did not move from the spot until the following morning, when he greeted the sunrise with a smile and moved quietly away.

But for all his eccentricities, he was far from being abnormal or unbalanced. He fought like a lion in battle and was commended for bravery on the field of Potidaea (432 B.C.). And he was the most sociable of men, delighting in banquets at the houses of his friends, where he would exchange jokes or talk the profoundest wisdom with equal pleasure.

Socrates' wife Xantippe was notorious in Athens for her sharp tongue and evil temper; though it must be said for her that her husband's unconventional manner of life must certainly have been exasperating to a careful housewife. The sage once jokingly explained his marriage by saying: "As I intended to associate with all kinds of people, I thought nothing they could do would disturb me, once I had accustomed myself to bear the disposition of Xantippe."

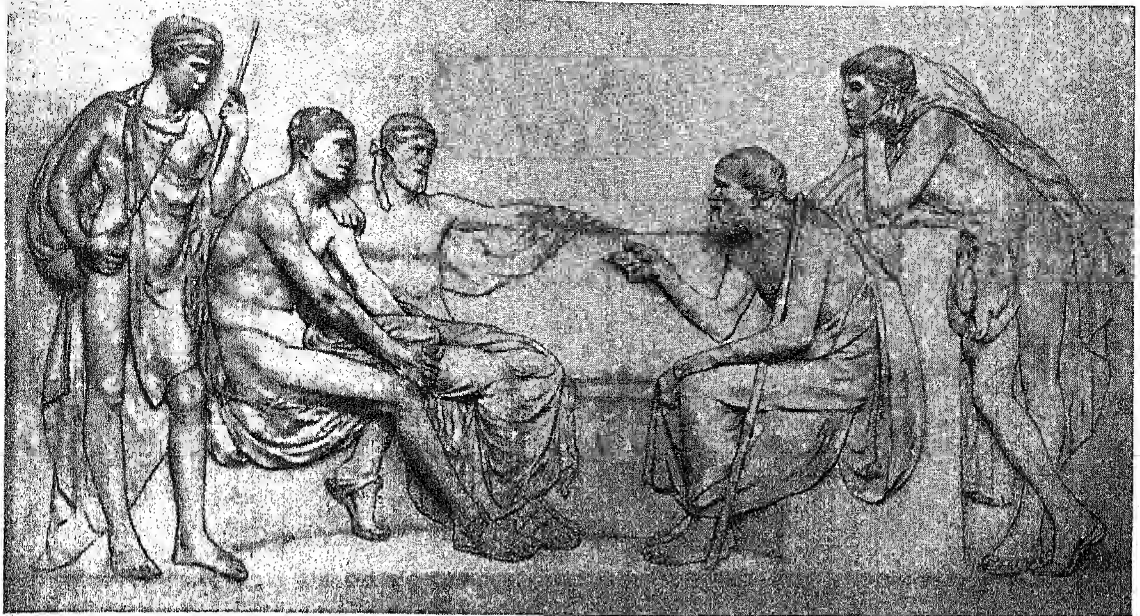
Socrates soon learned to shun the artificial philosophy of his day, which led men merely into confusion and doubt. He turned to the voice of his conscience for moral truth, and he enjoyed nothing better than to confuse with his simple human questions the pompous Sophists who valued tricks of speech and shallow eloquence above clear and distinct ideas.

"Know thyself," was his motto, and he held that wisdom is virtue, that the wise man is moderate in all things, for only so can he enjoy the keen delights of the mind. He had a sincere desire to expose the absurdities in the life and thought of his time, and he did not hesitate to risk his life for justice.

Although he did not set down a word of his teachings, so far as we know, the details of his life and of his doctrine are preserved to us in the writings of the historian Xenophon, and the great philosopher, Plato, both of whom were his pupils. It was chiefly through Plato and Plato's disciple, the brilliant Aristotle, that the influence of Socrates was passed on to succeeding generations of philosophers. (*See* Aristotle; Plato; Xenophon.)

But Socrates was not appreciated by the Athenian mob and their demagogue leaders. The genius of this "gadfly of Athens" for exposing pompous frauds made him many enemies. At last three of his political

THE YOUNG ALCIBIADES LEARNS WISDOM FROM SOCRATES



Bearded Socrates, gesticulating earnestly, is directing his arguments at the youthful Alcibiades seated opposite him. Behind Socrates is another aristocratic young Athenian, not so intent on learning wisdom, if we may judge from his expression. This relief, which is notable for its graceful lines and harmony in composition, is the work of the English sculptor Harry Bates (1850–1899).

foes indicted him on the charge of impiety and corrupting the minds of the youth, and he was sentenced to die by drinking hemlock poison. Refusing to flee, at the appointed hour he swallowed the fatal draught and in the midst of quiet conversation with his friends died as he had lived, a man of unsurpassed courage. "Such was the end," says Plato, "of our friend, whom I may truly call the wisest, justest, and best of all the men I have ever known."

SODIUM. Compounds of sodium flow dissolved in your blood and other body fluids. They season your food and lighten your tea biscuit and cake. They help to tan the leather for your shoes and to bleach the cloth for your garments. They form part of the glass of your windows and your tableware. They probably helped to produce the paper your books are printed on and to finish your photographs. They quite certainly entered into a hundred industrial processes whose products you use daily. In short, animals would cease to breathe and civilization as we know it would stop without the compounds of the silver-white, wax-soft metal sodium, which no one had ever seen or even imagined to exist 125 years ago.

Sodium, usually in compounds called "sodas," rules industry as potassium rules agriculture. Potassium compounds are so nearly like the parallel sodium compounds, to be sure, that the one can generally be substituted for the other in industrial processes, though the end product is not always an exact equivalent. Thus, we can use either caustic potash or caustic soda in making soap, obtaining soft soap from the potash and hard soap from the soda (*see* Soap). Sodium silicates or potassium silicates, or both, can be used in glass-making (*see* Glass), with certain resultant differences in the qualities of the glass.

The overwhelming reason why soda rather than potash is one of the foundation stones of modern industry is that soda is cheaper and more plentiful. Sodium and potassium are about equally abundant in the earth's crust, but ever since Nicolas LeBlanc in 1791 laid the foundation of modern industrial chemistry by discovering a process for making soda out of common table salt (*see* Acids and Alkalies), the world has had access to an inexhaustible source of supply of useful sodium compounds. This is not yet true of potassium compounds. So long as the sea is salt with sodium chloride ($NaCl$, common salt), we shall never have a "soda famine" as we have had "potash famines."

The compound properly called "soda" is sodium carbonate (Na_2CO_3), which, when crystallized with water, forms the ordinary washing soda or sal soda. Crude sodium carbonate is called soda ash. "Soda" is used in household cleansing, in manufacturing soap, glass, dye-stuffs, and explosives, in other industries of a scientific or technical nature, and as material from which other sodium compounds are made. Other important sodium compounds, with some of their uses, are: baking soda or saleratus (sodium bicarbonate), ingredient of baking powder; borax (sodium borate), a food preservative and flux in glass-making and metal industries; caustic soda (sodium hydroxide), used in soap-making and mercerizing cotton fabrics; sodium benzoate, a food preservative; sodium thiosulphate (the photographer's "hypo," formerly known as hyposulphite), for fixing nega-

tives in photography; sodium hyposulphite (a different compound), for bleaching and dyeing; sodium disilicate ("water glass"), for preserving eggs, fireproofing wood, theater scenery, etc.

Sodium belongs to the group of elements known as alkali metals (*see* Alkali Metals). It is never found uncombined in nature, and was first isolated by Sir Humphry Davy in 1807. Pure sodium instantly oxidizes when exposed to the air, and it decomposes water with a violent reaction, seizing the oxygen and a part of the hydrogen and liberating the rest. The pure metal is usually obtained by the electrolysis of sodium hydroxide, after which it is stored under kerosene.

One of the few uses of pure sodium is in the manufacture of sodium vapor lamps. In principle they are similar to other glow lamps (*see* Electronics). The globes contain some neon, which gives a reddish light when the current is first turned on. This heats and vaporizes the sodium in the globe, and the light turns yellow. Sodium lamps give two or three times as much illumination as filament lamps with equal current. They are much used along highways.

How Soda Is Manufactured

The historic LeBlanc process produces soda by first heating salt (sodium chloride) with sulphuric acid. The sodium in the salt and the hydrogen in the acid change partners, producing hydrogen chloride or hydrochloric acid, and sodium sulphate or "salt cake." The hydrochloric acid passes off to be absorbed by water; the salt cake is treated with charcoal and chalk or powdered lime, producing a mixture of sodium carbonate and calcium sulphide called "black ash." The calcium sulphide is not very soluble in water; the sodium carbonate is; so the two are separated by washing out the sodium carbonate with water.

The hydrogen chloride and calcium sulphide were at first great nuisances, but about the time what is now known as the Solvay process was put on a commercial basis (1863), these hitherto troublesome wastes became valuable, the hydrochloric acid being largely used in industry and a method being found for the recovery of the sulphur from the sulphide.

The Solvay process (known by the names of the Belgian manufacturers who perfected it), which has largely superseded the LeBlanc, is essentially the treatment of strong ammonia-saturated salt brine with carbon dioxide gas, forced through it from below. The end result of the complicated reactions that follow is the production of ammonium chloride or sal ammoniac and sodium bicarbonate ($NaHCO_3$) or "baking soda." The sodium bicarbonate forms a crystalline precipitate, which is filtered out. This is then heated, driving off hydrogen, carbon, and oxygen, and leaving sodium carbonate (soda).

A still newer process is the electrolytic. The salt molecule in salt brine is split by the electric current (*see* Electrolysis) into sodium and chlorine. The sodium atom displaces one of the hydrogen atoms of the water, forming caustic soda (NaOH).

SOFIA (*sō-fē'ä*), BULGARIA. From its general appearance, Sofia, the capital of Bulgaria, might almost be mistaken for a French or even an American city. It is not so picturesque as most of the Balkan cities, but it is cleaner, more modern, and more progressive. There are broad well-paved streets, electric lights, street railways, comfortable houses, and substantial public buildings. Of the old city there still remain the ruined Sofia mosque and the mosque of Buyuk-Jami, now used as a national museum and library, and the famous baths with hot springs; but the tumbledown houses and crooked streets that belonged to the days of Turkish rule have disappeared.

Situated in a mountain-girt plain, almost in the center of the Balkan peninsula, at the meeting-place of the principal highways of Bulgaria, and connected by rail with Constantinople, Belgrade, and Saloniki, Sofia is naturally a commercial center, and carries on a thriving trade in grain, hides, and attar of roses. The manufactures include silk, cloth, pottery, and tobacco. Sofia is just as progressive in education as in business. There is a university with more than 2,000 students, including many women; and also military and other schools.

Sofia stands on the site of the ancient town which the Romans called Serdica. It was taken by the Bulgarians in the 9th century; it was captured by the Turks in 1382, and occupied by the Russians in 1878. Population, about 290,000.

The LIFE-GIVING SOIL, *More Precious Than Diamonds*

SOIL. Our most important natural resource is soil. Without it, plants could not grow; plant-eating animals could not live; therefore meat-eating animals would perish. Soil, like water and air, is indispensable to all life on land.

It differs from water and air, however, in one great respect. The earth has plenty of air and water; but the supply of usable soil is extremely limited.

What is "usable soil"? It is the layer of loose surface material, often called *topsoil*, which contains plant food. The next layer, or *subsoil*, also has loose materials; but it has little or no plant food. Beneath it is a *substratum* of gravel, clay, or bed rock. Land life, therefore, depends upon the topsoil. How thick is it over the earth?

Along the lower courses of great rivers, the good soil may be scores or hundreds of feet thick; but in most places it extends down only a few inches or a few feet. The average depth on American uplands is estimated at seven inches. This soil coating of the earth is thinner, comparatively, than is the fuzz on a peach; yet without it, all land life would perish.

Why We Need to Know About Soil

We may think that, even if the topsoil is thin, we have all we need. This is wrong, for the fertility of the soil is being exhausted at an incredible rate.

We ship huge crops of vegetable foods and plant-fed animals to cities; most of the food values thus taken from the soil never come back. Careless or ignorant farmers also allow erosion by water and wind to strip topsoil from the land.

The replacement of such losses is amazingly slow. Nature takes from 500 to 1,000 years to make one inch of topsoil. From 2,500 to 10,000 years may be needed to replace a loss of from 5 to 10 inches of eroded topsoil. Hence we must learn to conserve our soil. (*See* Agriculture; Conservation; Land Use.)

How Rocks Weather into Soil Materials

Most soil materials were made originally from rock by *weathering*, or breakdown of the rock by sun, water, wind, gravitation, plants, and chemical action.

Sunshine heats a boulder, then a cool rain falls. A film on the boulder surface chills, contracts, and splits off. The rain carries the fragments down the mountainside, and they rasp away more material.

Wind hurls sand like a sand blast against rocks, and rubs away material. In winter water freezes in the cracks, expands, and splits off pieces, often with a noise like a pistol shot. Boulders and even avalanches break loose, and grind and smash rock as they fall. Trees rooted in crevices fall and break loose more rock.

Rocks are further weakened by the action of oxygen, which combines with many substances such as the iron found in most rocks. We see the iron oxides as reddish or brownish stains.

Carbon dioxide and water together form carbonic acid, which attacks most rocks, but particularly limestone and other rocks containing calcium. The resulting calcium carbonate is dissolved away in water, and in time the limestone is destroyed.

Nitric and nitrous acids, formed by lightning and moist air, attack rocks. Perhaps 25,000 tons of nitric acid are formed daily over the earth.

Granite contains particles of quartz and mica, cemented together by silicates. Various chemical agents transform the silicates, perhaps into clay. The separate quartz particles form sand (*see* Clay; Sand).

Such processes in time turn all rock into gravel, sand, silty material, and dissolved material. (Gravel includes pieces thicker than 2 millimeters, or about 8/100ths of an inch. Pieces down to 1/16th of a millimeter are sand; finer particles form silt or clay.)

How Soil Materials Become Organized

On sharp slopes, weathered material falls away and exposes more rock to attack. On gentle slopes or level surfaces, such material may lie in place, protecting the rock and settling into a *residual* formation. Residual formations (Fig. 1) show an even gradation from fully weathered material at the top to unchanged parent material at the bottom. The chemical character of the parent material may persist strongly. Granite, for example, tends to form acidic soil; limestone lends an anti-acid, or basic, character.

CONTRASTING SOIL FORMATIONS

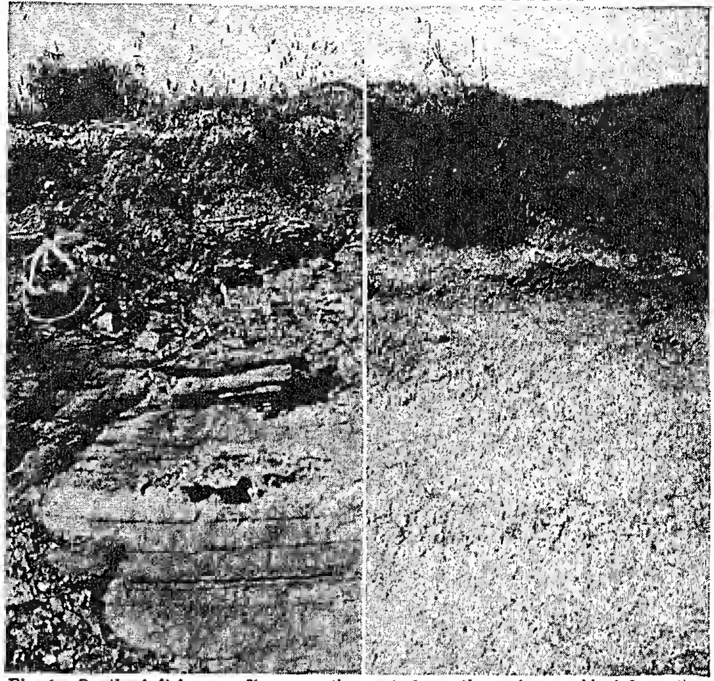


Fig. 1. On the left is a profile or section cut down through a *residual formation*. This is the result of the weathering of rock in place and the materials are graduated evenly from soil on top to unaltered rock at the bottom. At the right is an *alluvial formation*, showing a distinct dark layer of water-borne material.

Most soil materials, however, are *transported* to some extent. A swift stream can roll gravel along, and carries sand and silt indefinitely. When it slows, the gravel drops out first, then the sand, and finally the silt. Water-made, or *alluvial*, deposits usually form a distinct layer over other material (Fig. 1).

Strong winds may deposit sandy or silty materials hundreds of miles from their sources. Such wind-made, or *aeolian*, formations are fine and powdery. When such material becomes packed, it is called *loess*. Usually it is yellowish in color. When loess is cut or eroded, it falls away in squarish blocks, leaving sharp, upstanding edges. North China and Nebraska have extensive deposits of loess (Fig. 2).

Many soils have been developed in glacier-made, or *morainic*, material. An advancing glacier grinds the rock beneath with terrific power. When it retreats, it leaves a jumble of material, including boulders, which becomes *drift* soil. In many regions, such as the Columbia River basin, volcanoes have provided soil materials such as decayed lava and volcanic ash. These form *volcanic* or *volcanic ash* soils.

Texture and Tilth

The materials in a soil and its formation affect its texture—its coarseness or fineness and the way it

SOME OF NEBRASKA'S FAMOUS LOESS

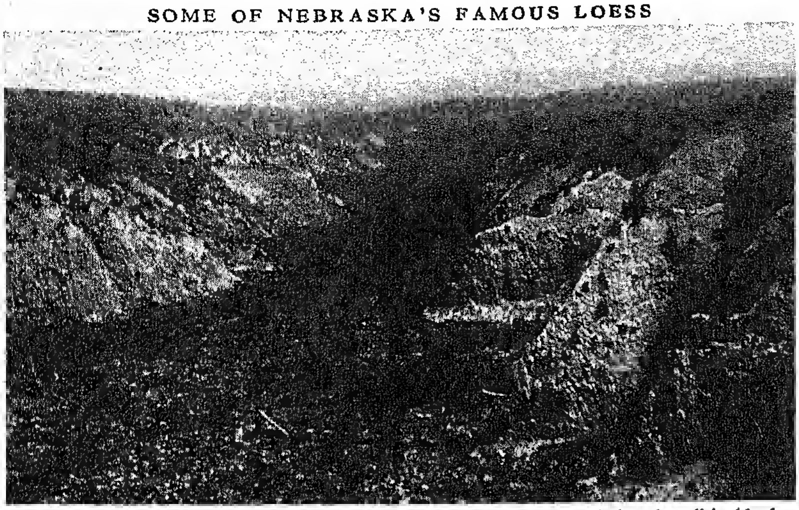


Fig. 2. Note how this loess, or soil made from wind-blown material, breaks off in blocks with squarish, upstanding edges, when occasional rains erode it on each side of the gulley.

breaks up. Texture in turn affects plant life, because root hairs work through the *pore space* between particles, and this space depends upon texture.

Moreover, plants get food, not from solid particles, but by soaking up water in which the foods are dissolved. The finer and more closely packed the particles are, the more water and food a soil can hold. Sand dries out rapidly, while clay holds water well. But if the pore space fills with water, plants "drown" because their roots cannot get air. Fine particles also hold water bound, or *adsorbed*, on their surfaces (*see* Colloids); plants cannot use this water.

A coarse-textured surface speeds evaporation by exposing water to air, and then draws more water up by capillary attraction (*see* Capillary Attraction). A fine-textured surface holds water better; hence dry farmers powder the surface to conserve water.

Air supply too depends largely upon texture. Warm air works quickly into coarse, sandy soils in spring; hence such soils are called *warm* or *early*. Fine-textured clay soils are *cold* or *late*.

Tilth, or behavior of soil under cultivation, depends partly upon texture. Soil with loose, small particles may crumble to powder when worked. Other textures are called crumb, plate, massive, pyramidal, or nut, according to the way the soil breaks up. Soils are also classed as *light* or *heavy*, meaning easy or hard to work. A farmer calls sand light, and clay heavy, though a cubic foot of sand weighs about 100 pounds, and dry clay about 75 pounds.

How Plants and Animals Help Make Soil

When plants die, water leaches plant food from them, and carries it down into the pore space. This organic matter, or humus, gradually turns the soil into *loam*, which is soil rich in organic matter.

Plant roots help water to drain or percolate into the soil. In dry times capillary attraction draws water up the channels made by the roots, bringing with it material which has leached down. Plants also draw up water which escapes, or transpires, from the leaves. Plant rootlets may split the strongest rock, by working into cracks and exerting pressures of from 200 to 300 pounds a square inch (*see* Plant Life).

Soil is enriched also by the wastes and decayed bodies of animals. Some animals—ants and earthworms, for example—help by mixing the soil (*see* Earthworm). Many insects indirectly enrich soil by fertilizing flowers and thus aiding the spread of plant life (*see* Bee; Flowers).

What Plants Need From Soil

The value of soil depends upon the supply of plant foods it contains. Plants must have ten chemical elements, called *essential* elements. These are oxygen, carbon, hydrogen, nitrogen, phosphorus, potassium, sulphur, calcium, magnesium, and iron. Some, perhaps all, plants also need traces of the *minor* elements—boron, chlorine, copper, iodine, manganese, silicon, sodium, molybdenum, and zinc.

Three-fourths of the weight of living plants is water (oxygen combined with hydrogen). Of the *dry* weight, 11 per cent is carbon, 10 per cent oxygen, and 2 per cent hydrogen, all obtained largely from water and carbon dioxide from the air. Only 2 per cent of the plant's weight comes from the soil. But the amount of these elements needed for crops is tremendous.

About 60 pounds of nitrogen, 11½ pounds of phosphorus, and 32½ pounds of potassium are needed to produce 35 bushels of wheat. A 75-bushel yield of corn takes 108 pounds of nitrogen, 18⅓ pounds of phosphorus, 64 pounds of potassium, and 9 pounds of calcium. Two 500-pound bales of cotton take about 164 pounds of nitrogen, 22 pounds of phosphorus, 81⅓ pounds of potassium, and 83 pounds of calcium.

Nitrogen, Phosphorus, and Potassium in Soil

Soils vary greatly in their content of nitrogen, the most important element by weight. Some piedmont and sandy soils have less than 800 pounds to an acre; peats may have 34,000 pounds. Good soil of 7-inch depth should have about 5,000 pounds to the acre.

Plants need nitrogen to make proteins (*see* Proteins); but they cannot use pure nitrogen from the air. A few plants can get nitrogen from ammonia, but most plants must get it from nitrates (*see* Nitrogen). Lightning and moist air make some nitrates, but not enough. The main supply, from 15 to 40 pounds a year to the acre, is made from the air by certain bacteria (*Azotobacter chroöcoccum* and *Clostridium pasteurianum*). Another nitrogen-fixing bacterium (*Bacillus radicola*) lives on the roots of leguminous plants such as clover, alfalfa, peas, and beans. By some unknown process it supplies nitrates to the plant in

return for carbohydrates. When the plants die and decay or are plowed under, the nitrates are added to the soil. Decay of dead plants and animals, caused largely by bacteria, changes the nitrogen compounds they contain to ammonia. Certain bacteria (*Nitrosomonas* and *Nitrosococcus*) build the ammonia into nitrites; others (*Nitrobacter*) build the nitrites into nitrates, which plants can use.

Nitrogen is lost from the soil in many ways. Nitrates dissolve in rain water and are carried off. Crops and food animals constantly take it away. On the other hand, nitrogen-fixing bacteria are active only when the temperature is between 54° and 130°F., and nitrite-forming bacteria do not act in acid soil. Hence, after a few years of farming, most land lacks the nitrogen needed to produce well, unless nitrogenous fertilizers are applied (*see* Fertilizers).

Phosphorus and potassium also may become exhausted. Natural replacement of the compounds containing these elements is extremely slow or even lacking in many regions, and phosphate fertilizers must be used to supply phosphorus, and potash fertilizers for potassium. The minor elements too may be lost, reducing both the resistance of plants to disease and pests, and also the food value of crops (*see* Minerals).

SOILS FROM TREES AND GRASS

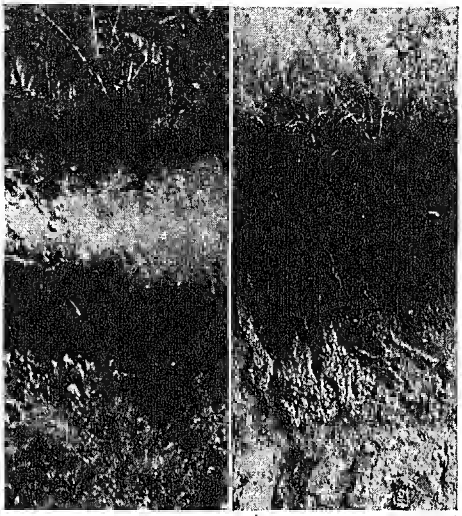


Fig. 3. At the left is the profile of a *podsol*, or soil formed beneath a cool pine forest. At the right is a rich black *chernozem*, in the western wheat country.

Modern Theories of Soil Formation

Until recent years, soil scientists thought of the soil as a mere storage bin, into which parent materials and organic matter were poured, and from which plants drew what they needed. Before the first World War, however, various Russian workers discovered a surprising new principle of soil formation. They found that every soil, far from being a mere storage bin, changes slowly through the centuries, in response to the climate of the region, until its character matches the climate just as does the plant growth.

These changes are produced, largely by water action, in layers or *horizons* of the soil. In moist climates other than polar ones, the top layer, or topsoil, loses material by leaching to the subsoil. Hence these layers or horizons are called the zones of *eluviation* and *illuviation* (meaning, respectively, zones of loss and of gain by water action). In dry climates, however, rapid evaporation after a rain promptly brings up as much dissolved material as the rain carried down, and perhaps a little more.

These two horizons (topsoil and subsoil) taken together are called the *solum*, to distinguish them from the substratum, or third horizon, which does not change. For convenience the three horizons usually are called horizons A, B, and C, from top to bottom. Together they form the *profile*, or complete section, of the soil (Figs. 1 and 3).

Polar-Climate or Tundra Soil

The simplest effect of climate upon soil is seen in polar tundras. Here the soil is always frozen, except for a thin layer (horizon A) which thaws in summer. Since nothing can leach down to the subsoil (horizon B), this horizon shows the same dirty gray color as the substratum (horizon C). Horizon A is streaked with brown humus, obtained from mosses and lichens.

Soils in Wet and Dry Climates

Elsewhere the soil thaws deeply, and can undergo extensive change, according to climate. The changes are classified, first, according to whether the climate is wet or dry.

The chief change in wet-climate soils is leaching of soluble nitrogen compounds, and lime salts or compounds of calcium, from horizon A to horizon B. Calcium salts are basic, or anti-acid (*see* Acids and Alkalis). Loss of them leaves the topsoil with an acid character, due chiefly to acid compounds of iron and aluminum. Curtis F. Marbut, who did most to apply the Russian ideas to American soils, called such a soil a *pedalfer*, from the Greek word *pedon* for ground, *al* for aluminum, and *fer* for *ferrum*, or iron.

In dry climates this action is reversed. Instead of being leached down, the calcium salts tend to be brought up by evaporation after every rain. This action may develop a layer of calcium carbonate in the topsoil. Such soils are called *pedocals*, from *pedon* and *cal* for calcium. So-called alkali soils are pedocals, although calcium carbonate is not an alkali.

In the United States, this great division between wet-climate and dry-climate soils occurs midway across the country, as shown in Fig. 4. Within each division, the soils may be classified further according to changes produced by other factors. In wet-climate soils, the principal further factor is temperature.

Forest Soils in Cool and Temperate Climates

Moist climates favor the growth of trees. In cool, moist climates, where the trees are conifers (evergreens), the combination of abundant moisture, coolness, and conifers produces a soil called a *podsol* or *podzol* (Fig. 3). The term means "salty soil."

This soil is acid, for two reasons: first, because calcium is leached away; and second, because coniferous trees do not use much basic (alkaline) material and hence do not restore such material to the soil when the leaves and wood decay. It is also poor in nitrogen, because the long winters hamper the nitrogen-fixing

THE MAJOR SOIL REGIONS IN THE UNITED STATES

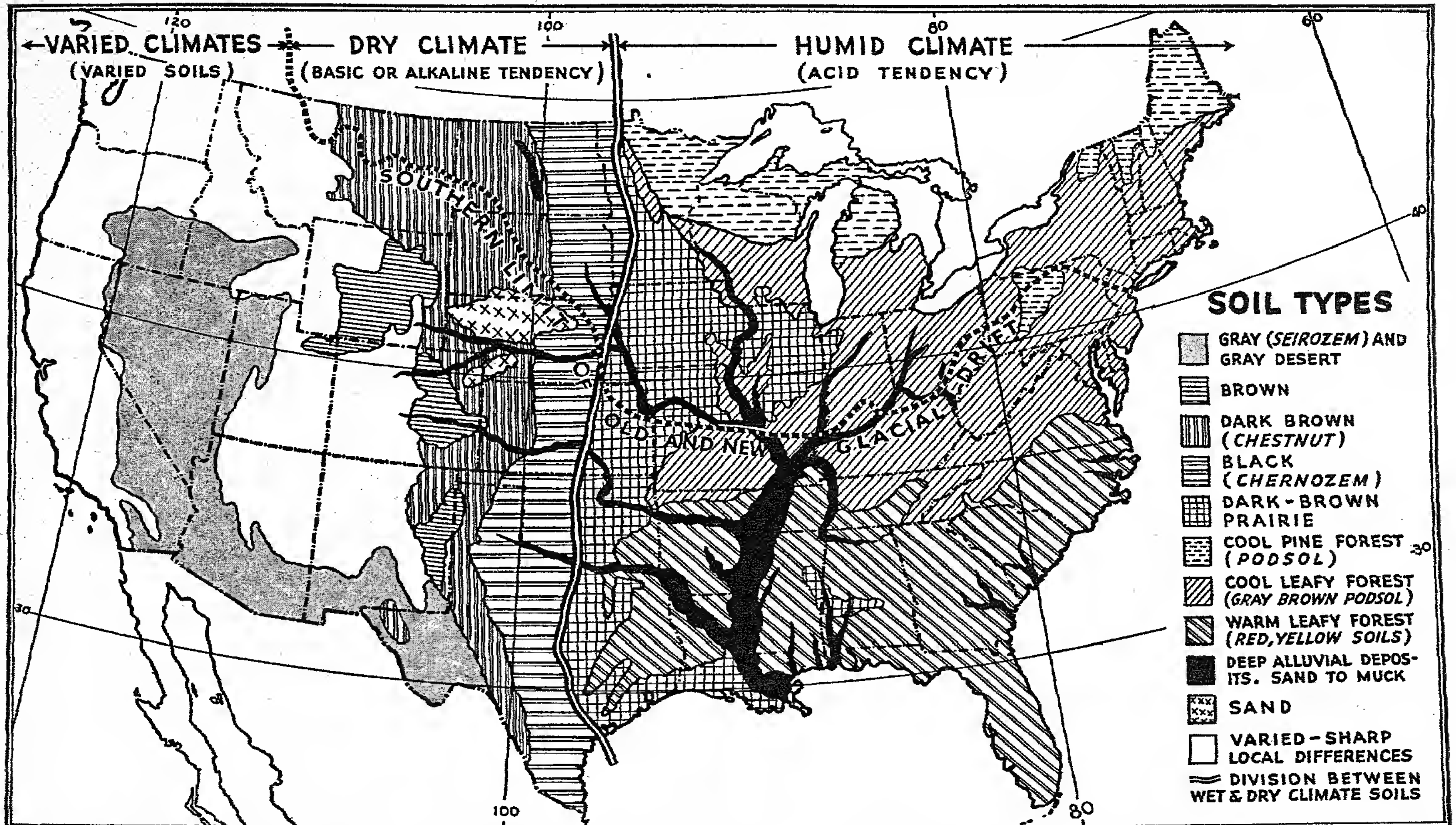


Fig. 4. This map shows the principal types of soil which have been developed by climatic forces in the United States. To trace the regions, note first the division, somewhat east of the 100th meridian of longitude, between the acid and the basic soils (*pedalfers* and *pedocals*). This matches the division between humid and dry climates; it should be compared with the map in the article on Drought, and various maps in the article on the United States. Note also how soils in moist climates vary from north to south, according to temperature and the kinds of trees the climate supports. Within each soil region, the soils developed by climate may vary, according to the way the soil materials were deposited. Thus, the great rivers in the Mississippi Valley are bordered by alluvial deposits, which in time take on the character appropriate to the climate. The glacial drift soils also vary from east to west, according to climate. In the mountainous region of the West, a desert area stands out clearly. Otherwise, the soils vary greatly from valley to valley, according to the rainfall and other conditions; but the differences cannot be shown on a map of this size. In the East, an interesting local variation which is large enough to show on the map is the patch of dark-brown prairie soil in Alabama and Mississippi. This is kept from sharing the regional acid tendency by an underlying formation of limestone.

bacteria. The profile of such a soil shows an A horizon with two layers—an upper A_1 layer of raw humus, and a lower A_2 layer having an ashy or salty appearance. The B horizon is stained reddish-brown by iron compounds and humus. Such soil is extremely poor for farming.

In milder climates, deciduous trees (those that shed their leaves in winter) tend to supplant the conifers. These trees use more basic materials than do conifers, and so help correct acidity in the topsoil. Longer summers promote nitrogen enrichment; plant life and humus are more abundant. The resulting soil, known as a *gray-brown podsol,* is good for crops. It shows an A_1 horizon of humus, an A_2 horizon from gray to brown in color, and a B horizon stained brown by humus and iron compounds. This was the soil usually found by the settlers who cut down the forests to obtain farms, between the Appalachians and the Mississippi River.

HOW LIMING HELPS ACID SOIL

Fig. 5. The right half of this field was treated with crushed limestone; the left half was untouched. The difference in growth proves the value of the treatment.

Warm-Forest and Tropical-Forest Soils

In warm temperate climates, loss of calcium and strong oxidation of iron give the soil profile a red or yellow color. Completely oxidized (ferric) iron gives red; incompletely oxidized (ferrous) iron gives yellow. Thus *red soil* and *yellow soil* are formed.

In regions such as the Congo and Amazon river basins, the heavy tropical rainfall leaches away nearly all plant food, and the soil is red with ferric oxide. Plants get food, not from the soil, but from the decayed material on top of the soil. Particles of such soils have a jelly-like film of minerals, which hardens and lumps the soil when exposed to air. Hence these soils are called *laterites* (from the Latin word *latus,* for brick).

Soils in Deserts and Subhumid Climates

In dry climates, the soils differ principally according to the amount of moisture they receive, ranging from none to about 20 inches of rainfall a year.

In complete deserts, the soil has a light-gray or whitish-yellow profile, and is called *gray desert* soil. Where scant rainfall produces a few grasses and other plants, the soil has brownish streaks of humus, and is called a *gray soil,* or *seirozem.*

As moisture increases, so does humus. Thus we have *brown* soils, and *dark-brown* or *chestnut* soils. In the subhumid belt of somewhat less than 20 inches of rain a year, we find deep *black* soil, with a lime-colored subsoil, because calcium salts are not leached away. The Russian name for this soil is *chernozem,* meaning "black soil." Because of its humus and calcium, this soil is fine for wheat (Fig. 3).

Between the humid belt and the subhumid belt in the United States lies *dark-brown prairie* soil. It has deep humus, but it is brown rather than black. It is not so rich as a chernozem, but better rainfall makes it more valuable for general farming.

Soil Management to Maintain Fertility

Because of the various qualities of these different soils, soil management—planning of crops, cultivation, and use of fertilizers to maintain fertility—must vary in different parts of the United States. In the East, the most common soil trouble is a tendency to become *acid* or *sour.* Acidity not only hurts crops, but it prevents growth of clover and replenishment of nitrates. The remedy is crushed limestone, added as indicated by the *Comber test.*

To make this test, potassium thiocyanate is dissolved in grain alcohol, 25 grams of chemical to each 25 cubic centimeters of liquid. Each soil sample is shaken well, and allowed to stand for ten minutes. Lack of color indicates no acidity. A faint pink indicates need for two tons of limestone to the acre; a light cherry, 3 tons; and a deep cherry, 4 tons. After liming, a crop rotation starting with clover may give double yields and much better quality (Fig. 5).

The remedies for alkalinity depend upon the kind of soil, the local climate, and whether irrigation is used. No general rules can be given.

Official Classifications of Soil

Government soil maps and surveys classify soils, first by *series,* and second, by topsoil *texture.* A series has a certain order of materials below the topsoil; the series name, taken from the locality where the series was first studied, is used wherever this order of materials is found. For example, "Miami loams" may occur far from Miami.

The official texture types are *sandy,* with less than 20 per cent silt and clay; *sandy loam,* with from 20 to 50 per cent loam, silt and clay; *loam,* with 30 per cent or more loam; *silt loam,* with 50 per cent or more of silt, and 20 per cent or less of clay; *clay loam,* with 20 to 30 per cent clay; and *clay,* with 30 per cent or more of clay. These terms are added to the name of the soil type. Thus, we can have a silt or a clay Miami loam. Deep alluvial soils vary from gravel and sand to *muck,* which contains from 15 to 50 per cent organic matter.

SOLOMON, KING OF ISRAEL (about 960 B.C.). Nearly three thousand years have passed since King Solomon sat on the throne of Israel, yet his glory is still undimmed and his reign is celebrated as that of the wisest and most magnificent in Israel's history. Solomon was little more than a youth when he succeeded his father David. At the beginning of his reign, the Bible tells us God appeared to him in a dream and asked him to express a wish. Solomon prayed only for an understanding heart, that he might rule his people with justice. And because he asked not for riches, nor for long life, nor for power over his enemies, but for wisdom, God rewarded him by making him not only the wisest king of his age but the wealthiest and most honored as well.

Solomon showed his wisdom in small and in great affairs. He was called upon to decide a dispute between two women, who both claimed the same child. "Divide the living child in two, and give half to the one, and half to the other," said the wise king. Whereupon one of the women cried out and begged him to give the babe to the other, thus showing that she was the real mother, since she would rather give up her child than have it harmed (I Kings iii, 16–28).

The Queen of Sheba Visits Solomon

Not only his own subjects but rulers from distant lands came to consult Solomon. The Queen of Sheba, in Arabia, having heard of Solomon's fame, came with a great train, bearing gifts of spices and gold and precious stones. Greatly did she marvel when Solomon answered all the questions and riddles which she put to him and showed her all the splendors of his court. "Behold, the half was not told me," she said to Solomon; "thy wisdom and prosperity exceedeth the fame which I heard."

Princes of many lands brought gifts of friendship and formed alliances with him, and he built up a great foreign commerce such as the kingdom had never before seen. With the help of the Phoenicians, trading vessels were sent to Ophir (a land probably in southern Arabia, famed for its gold), and as far as Tarshish (probably Spain). Gold and silver, ivory, apes and peacocks, horses, and linen, were among the rich treasures brought to Solomon's realm. "And the king made silver in Jerusalem as stones, and cedars made he to be as the sycamore trees that are in the vale, for abundance." Peace was established and the people dwelt in safety, "every man under his own vine and fig tree."

Now that there was rest from war, Solomon was able to carry out the purpose which his father David had cherished but had been unable to fulfill, the building of a great temple as a center of worship for all the land. After seven years this magnificent temple, built of stone and cedar of Lebanon, carved within and overlaid with pure gold, was completed and dedicated to Jehovah. Adjoining the temple Solomon built for himself a splendid palace, within which was placed the king's gorgeous throne, built of ivory and overlaid with gold.

But Solomon, for all his wisdom, had some very grave faults. He had many foreign wives, who turned his heart away from the pure worship of God. He allowed them to build altars to their divinities, and thus idolatry was brought into the land. In order to maintain his luxurious court, he taxed the people heavily and caused much discontent at the close of his reign. As the king's character weakened, so did his hold over the people, and his death was the signal for the division of the kingdom. On the supposed site of Solomon's temple on the eastern hill of Jerusalem, there stands today the Mosque of Omar, making the spot almost as sacred to the Mohammedan as Mecca.

SOLON (about 638–558 B.C.). In the market-place of ancient Athens a crowd was once gathered about a man who, from his disordered clothing, his wild gestures, and his flashing eyes, appeared to be stricken with madness. Suddenly he broke forth in verse:

I come as a herald from Salamis, beautiful island,
And the message I bring to your ears, I have turned into song.

The crowd listened with amazement, for surely no sane man would risk his life by uttering such words. So many vain attempts had been made by the Athenians to retake Salamis from the neighboring state of Megara that in despair they had passed a law forbidding anyone, under penalty of death, to suggest another attempt. In the frenzied poet who now roused them with his stirring words they recognized the high-born Solon, who by thus feigning madness sought to escape the penalty for breaking this law. "On!" he cried—

On then to Salamis, brothers! let us fight for the beautiful island,
Flinging afar from us ever the weight of unbearable shame!

Carried away by Solon's appeal, the Athenians resolved to make one more attempt to win back the island. This time they succeeded and Solon became the hero of the day.

It was to Solon therefore that the Athenians looked in another great crisis, brought about by the new development of Athens as a commercial state. Great fortunes were being made in trade, while the lot of the laborer and peasant became harder and harder. Small farmers, obliged to borrow money at ruinous interest, were losing their mortgaged lands and were sold into slavery to satisfy their cruel creditors. A revolution threatened and the wise poet's voice was again heard:

Evil the fate of the city wheresoever misgovernment reigns,
Only good rule bringeth peace.

The people elected Solon archon—the highest office in the state—and gave him power to draft a new code of laws to displace the harsh old laws of Draco. Solon ordered all those enslaved for debt to be freed, forbade future loans on the security of a debtor's person, and cancelled all debts thus secured. He set a limit to the amount of land which a man might hold. He also improved everyone's chance of securing justice by a law providing that one who had lost a

lawsuit could appeal the case to a jury of citizens. He admitted every man, even the humblest, to serve on this jury and take part in the meetings of the assembly, and gave him a voice in the election of the magistrates, thereby laying the broad foundation of Athenian democracy.

Then, according to the old story, Solon caused these laws to be inscribed on wooden tablets, and binding the people to observe them, left Athens to travel for ten years. It was during this time that his legendary visit to King Croesus of Lydia is placed. (*See* Croesus.)

Although the revolution which Solon had sought to avoid did finally take place, with the result that Pisistratus, a member of a powerful noble family, seized supreme power, Solon's ideals of law and justice and democracy remained a powerful influence throughout Athenian history.

Solon was one of the Greek sages whom the ancients honored by calling the Seven Wise Men. Many famous sayings were attributed to them, such as "Nothing in excess"; "Know thyself"; "Moderation is the chief good." The names of the others usually included in this list are Thales, Periander, Pittacus, Cleobulus, Bias, and Chilon.

SOMME (*sôm*) **RIVER,** FRANCE. As an easy route for the invasion of France from Belgium, the Somme Valley has great historic importance. It saw bitter fighting in the World War of 1914–1918 and again when Germany conquered France in 1940.

The river is a peaceful stream only 140 miles long. It rises near St. Quentin, broadens to an estuary at Abbeville, and flows into the English Channel at St. Valéry, a small seaport and fishing community. The river valley, which corresponds roughly to the old province of Picardy, is one of the richest regions in France. The ancient cathedral city of Amiens is its commercial center.

Battles of the Somme during the World War

The first Battle of the Somme began July 1, 1916, and lasted until November 18. It is estimated that during those four months and a half, while the British and French were trying to break through the fiercely defended German lines, 500,000 men were killed on both sides and a million men more were wounded or taken prisoners.

The preparations for battle had been going on for months, particularly behind the British lines. There thousands of new troops, "Kitchener's men" as they were called, were eagerly waiting to meet the enemy and put their training to the test. Thousands of guns and millions of shells turned out by the new factories in England were massed in support of the infantry. It was to be Great Britain's first great offensive, launched while the French were still battling desperately to hold Verdun (*see* Verdun).

The line chosen for attack by Sir Douglas Haig, the British commander, extended north of the Somme in an 18-mile curve, facing the town of Bapaume, seven miles inside the German lines. The French coöperating armies were drawn up on an eight-mile front, straddling the Somme opposite Peronne.

After days of the fiercest artillery bombardment the British troops left their trenches on the morning of July 1 and advanced, expecting to find the enemy trenches battered to ruins. But the Germans, who had long known of Haig's plans, had built their dugouts so deep in the chalky soil that they had escaped the deadly effects of the British gunfire. As the attack approached, they swarmed up from their hiding places with countless machine guns and poured a withering hail of bullets into the advancing waves of men. At the same time the German batteries laid down a barrage behind the British, which not only cut off retreat but prevented reserves coming up. Surprised and trapped, the British fought with amazing courage and kept going ahead. By the end of the first day, they had lost 50,000 men, but they had gained caution and respect for an enemy that fought with a valor equal to their own.

Meanwhile the French to the south had made good progress, and during the following two weeks the first German line was taken. For the next three months after that the Allied forces pressed on step by step, taking small villages at enormous sacrifice of troops, but never succeeding in breaking through the German line. The approach of winter and the exhaustion of the men put an end to the active fighting, leaving Bapaume and Peronne still in German hands.

Although this battle was partly responsible for the retirement of the Germans the following spring to the famous "Hindenburg Line," its general results were small compared to the loss sustained.

The Second Battle of the Somme

The second Battle of the Somme, sometimes called the Battle of Picardy, marked the opening of the great German offensive in the spring of 1918. Beginning March 21, the Germans thrust out from St. Quentin toward the great railway center at Amiens, hoping to break the line of communication between the French and British armies (*see* Amiens). They advanced rapidly more than 20 miles, retaking all and more than they had lost in 1917. It was at this juncture, on March 26, that Gen. Ferdinand Foch was named to "coördinate" all the Allied troops. He organized a defense which by April 6 stopped the Germans just east of Amiens. The 11th regiment of United States engineers, who had been working on a British railway line, took a creditable part in the fighting. Four months later the Germans were driven out of the Somme Valley (*see* World War of 1914–1918).

The French "Last Stand" in 1940

In May 1940 Germany opened its western campaign with a fierceness which gave it Belgium, and France north of the Somme, by June 4. On the following day, the Nazi forces struck against the French in their defensive position stretching along the Somme and the Aisne rivers, from the English Channel on the west to the Maginot Line far to the east.

The French held for several days, until their last reserves were spent. Then the defense crumbled, and on June 16 France asked for an armistice.

SORGHUM. When we hear the word "sorghum," most of us think first of syrup, for the United States makes 30,000,000 gallons or more of sorghum syrup every year. Sweet sorghum (or sorgo) is grown in every state in the Union, though manufacture of the syrup for the market is largely confined to southeastern and south central states. Sweet juice in the plant stems is extracted by grinding, and reduced to a thick syrup by boiling and evaporation. Most sorgo syrup manufacturing is done on farms, not in factories.

Many varieties of the sorghum, however, are not sweet, and really the most important use in the United States for sorghum, even the sweet sorghum, is for forage and grain. It makes excellent pasturage for hogs, sheep, cows, and horses and is also fed as hay or put in silos. Sorghum seed, ground, especially that from grain sorghums, makes a good feed for live stock, as does also the ground stock fiber or refuse left after syrup making. Kafir is one of the best-known grain feed varieties (*see* Kafir). Another interesting member of the sorghum group is broom corn, which grows the thick and strong seed-head or brush used in the manufacture of brooms.

THE MOST VALUABLE SORGHUM

This is Kafir, commercially the most important of the sorghums. It was introduced into the United States about 1885, and is a valuable grain and forage crop in many Western states.

Milo, feterita, durra, and shallu are other well-known and useful grain varieties. Sudan grass, a grass sorghum first obtained from Khartum in 1909, is grown widely in the United States for pasture and hay.

Sorghum was cultivated 4,000 years ago in Africa and in some parts of India and China. In these countries it is valued today chiefly for its seed, which is a staple food of the natives. Some of the non-saccharin (sugarless) sorghums are particularly valuable crops in regions where the rainfall is light, such as the dry-farming areas of western United States.

The sorghums (botanical name *Andropogon sorghum* or *sorghum vulgare*) belong to the grass family. They have jointed, pithy stems, growing 4 to 20 feet tall. The plant resembles Indian corn (maize) except that it is earless, the seeds growing on the top of the stalk.

The VIBRATIONS *of* MATTER *Which We Call* SOUND

Why Sounds Grow Fainter with Distance—Why We See a Lightning Flash Before We Hear the Peal of Thunder—the Difference Between Noise and Music

SOUND. When you hear a sudden sound you look in the direction from which it seems to come. You expect to see something happening, some movement to account for the disturbance. You assume—and rightly—that whenever there is sound there is always something moving to produce it. The noise of an explosion follows an extremely violent motion caused by the explosive. The blades of an electric fan must be in motion before we hear its buzzing sound. When you speak, the vocal cords of your throat are vibrating; and so with every sort of sound.

This gives a good starting point for understanding sound, first disposing of the old question: if there were no ears to hear would there be sound? There would be no sound, in the sense of *sensations registered on ears* (*see* Sensation and Perception); but the motion which creates this sensation would be there, and this is what concerns the physicist.

What Causes Sound?

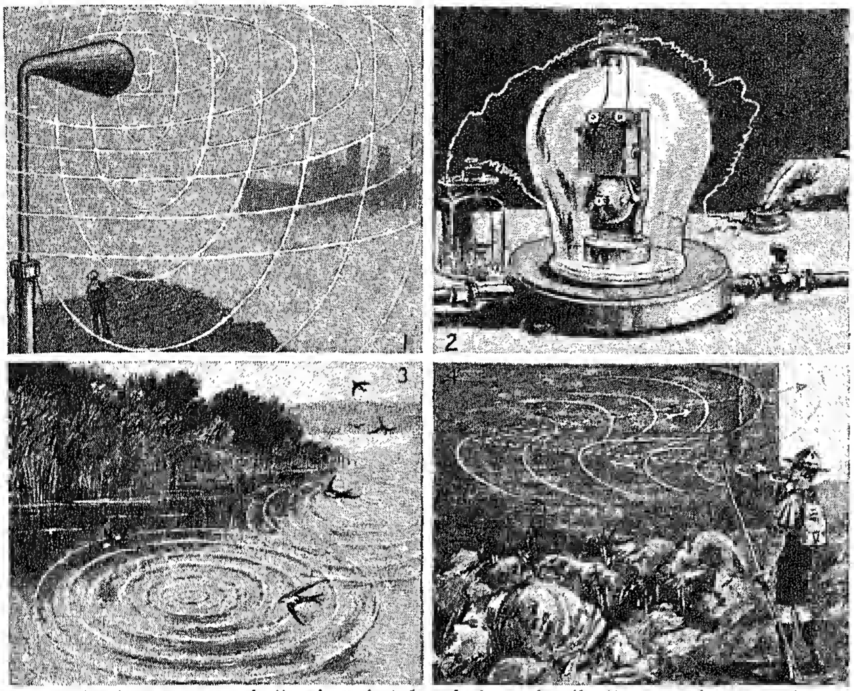
The whole general mechanism of sound can be readily understood from a single example—that of dropping a book on a table. When it strikes, the air between the book and the table top is suddenly squeezed out. Now air, thin as it is, has elasticity, as you know from the way the handle of a tire pump bounces back after being pressed, if you have plugged the outlet valve. Therefore when the air driven from between the book and the table strikes the near-by air, this is first compressed and then bounces outward, striking in turn the air farther away; and so the impact is passed on. If we should be in the vicinity, this outward impact would pass our ears, and in passing, would strike upon the ear drum. The nerve endings in the ear (*see* Ear) respond by causing our brains to "hear" the slap of the book striking the table.

Just as air yields to the pressure on it, so does the table, although, since the wood of the table is much denser than the air, the amount of yielding is far less. Since wood is reasonably elastic, this impact travels through it. If you place your ear against the end of the table, you will "hear" the sound as the impact comes through the wood.

Likewise sound travels through water, as you can demonstrate by holding your head under water, and having someone strike the surface near by. All sounds, in fact, are caused in just such a way as that described—by having some violent impact upon matter set up a strain in some elastic medium, and having this medium transmit the strain to where it can strike your ear, causing you to hear.

All this may raise the question, "Why, if displacement of matter causes sound, do we not hear something when we just move a book from one place to another without dropping it?" The answer is that such a disturbance can be adjusted by air flowing around the book, without any "impact" radiating outward as part of the adjustment. Sound results when the displacement is so sudden and violent that the compensating adjustment can only be completed by means of this outward radiation.

SOME FACTS ABOUT SOUND WAVES AND ECHOES



When vibrations are set up in the air, as in 1, by a foghorn, the vibrations travel as sets of great circular waves in all directions. An electric bell in a vacuum jar, shown in 2, is almost inaudible, proving that sound is not carried through a vacuum. The overlapping sets of waves made on the surface of the pool by the dipping swallows in 3 illustrate how sound waves in the air may cross one another in a similar way without interference. An echo is produced, as in 4, when sound waves are reflected by some obstacle, just as water waves strike the shore and roll back again.

Physical Features of the Sound Wave

What has been said explains the meaning of the scientific statement that sound travels by "longitudinal" pulses, and how this can take place regardless of whether the molecules are rigidly fixed in place, as in the wood in a table; are closely packed, but not fixed, as in water; or are freely flying, as in air. In all cases, the molecular motion is a to-and-fro one along the direction of the sound. The particles of the transmitting medium move back and forth, each over its own range, striking repeatedly those next to it. When the particles are pushed together, they form a zone of *condensation;* when they move back and spread out, they form a zone of *rarefaction.* The rate at which the condensations and rarefactions take place is called the *frequency* of the wave. The greatest distance each particle travels away from its original position is called the *amplitude* of the wave.

It is a natural tendency of elastic materials to "spring back" into their original positions after displacement, and in doing so, to overshoot the mark. Then they spring forward again; and gradually, by this back-and-forth action, come to rest. This behavior underlies the distinction between *noises* and musical *tones*. The slap of a falling book, the bang of an explosion, consist principally of one great "compression" wave, followed by more or less regular disturbances as the transmitting medium settles to rest. Such a sound is a noise. But the prongs of a tuning fork, the strings of a violin, and the vocal cords of the throat give forth a whole series of regular impulses. When this series strikes the ears of listeners its sustained regularity causes it to be heard as a tone.

The Speed of Sound

The elastic nature of transmitting mediums explains why all sounds travel at the same speed, at any given instant, through the medium. Once the original impulse has given an impact to the transmitting medium, the speed at which the impact travels depends entirely upon the rate at which the molecules of the medium react, and not upon the nature of the sound.

This speed can be determined readily in the case of air simply by timing the sound, as it passes different points. In air sound travels 1,087 feet a second when the air has a temperature of 32° F., increasing about 13 inches a second for each degree of rise in temperature. At ordinary room temperatures of from about 68° to 70° F., the speed is about 1,130 feet, or a little more than a fifth of a mile a second. This is slow in comparison with other kinds of wave motion, such as light, X-rays, and radio waves, for these travel at the rate of 186,270 miles a second. That is why light from the flash of lightning reaches us before the sound of the thunder. By counting the number of seconds between the flash and the thunder and multiplying by the speed of sound at the existing temperature, we can tell how far away a storm cloud is. Sound travels about four times as fast in water as in air. In steel it travels about 15 times as fast. A speaker in a large hall is heard by his radio audience a thousand miles or more away before his voice reaches his listeners in the back of the room where he stands because the air

waves from his voice transformed to radio waves travel for most of the thousand miles at the speed of light, while in the hall they are carried at the much slower rate of sound waves.

Intensity or "Loudness" of Sound

If the original disturbance is violent, the surrounding air "bounces out" to a considerable distance, forming a compression wave of large amplitude, before its first elastic rebound takes place. This "large amplitude" wave then travels outward, and strikes with violence upon the ear drum, causing us to hear the sound as loud. The amplitude, then, of the wave, is the physical factor determining loudness of sound.

It has been found that the intensity of sound diminishes according to the *square* of the distance traveled. Sound tends to spread outward in all directions, the various waves forming concentric spheres. But the surface of a sphere increases as the *square* of its radius (*see* Mensuration). Since the original energy must spread itself over the ever-increasing surface of the spherical wave, its intensity at any point must diminish according to the square of the distance traveled. A megaphone seems to increase sound by compelling the waves to start outward in a cone shape, keeping them from spending their energy as quickly as they would if they spread in all directions.

How the Vibration Rate Determines Pitch

All sustained sounds have *pitch*, the principal quality by which we recognize the difference between, say, a low organ tone and a high one. Experiments readily show that the pitch of a tone is determined by its frequency, or number of vibrations a second. One mechanism proving this is the *siren*, consisting of a disk pierced with holes, through which a blast of air or steam is directed. As the disk is whirled faster, more holes pass the blast every second, and the pitch of the siren's note rises.

A vibrating string likewise can be made to give notes of different pitch, by altering its length. If the full length be shortened—as when a violinist presses a finger on one of the strings of his instrument—the pitch given off is higher. In the piano there is a set of strings for each note, or pitch, to be played; the strings giving off the higher notes are shorter than the others, as you can see by looking inside the instrument (*see* Piano). This is similar to the arrangement in the cochlea of our ears, where different fibers respond to different notes, long fibers vibrating to low notes; short fibers to high notes.

The slowest vibration rate the ear can perceive is between 16 and 29 vibrations per second, depending on the sensitiveness of the individual ear. The greatest audible vibration lies between 20,000 and 30,000 per second. Sounds within this range are far from being all of musical quality, the range of true musical tones being from between 30 and 40 vibrations a second up to 4,000 a second.

High-frequency waves that cannot be heard can be detected by the *manometric flame*. In this apparatus the waves enter a gas-filled box connected by a tube with a lighted gas jet, and the flame *jumps* whenever struck by an incoming sound wave. The jumps can be seen when the flame is reflected in a rapidly revolving mirror.

Vibrations can be even more strikingly shown by producing them in certain crystals, in metal or glass tubes, by means of powerful electromagnetic coils, carrying 100,000 to 500,000 electric oscillations a second. When vibrations of the highest frequency are applied to quartz crystals, immersed in water to prevent them from flying to pieces, they kill small fishes in the water, and cause intense pain in the hand of the operator if he places it in the water. Waves of such high frequency are called *supersonic* waves. Those of somewhat lower frequency, of about 8,800 vibrations per second, become audible as a terrific squeak, and have the power of destroying bacteria and the red blood cells.

How Sound Is Reflected in Echoes

The picture on page 195 shows how the molecular motions, striking against a broad surface, such as a cliff or the side of a building, are sent on in a new direction, but in their original wave form. This explains the reflection of sound. Perhaps the best-known example of this is the *echo*, explained in greater detail elsewhere (*see* Echo).

Powerful sounds, like the firing of artillery, sometimes fade out and come again into hearing at greater distances, having been reflected from clouds. The repeated reflection of sound, echoing back and forth, is called *reverberation*. A certain amount of reverberation in a hall enriches the tone and gives life to the voice, but a little more gives a disturbing and irritating effect, and prevents clear hearing. Reverberations may be practically stopped with the use of heavy draperies or sound-absorbing wall materials. Planning rooms to control echoes and reverberations is a part of architectural acoustics.

The fact that sound can be reflected is used in various types of "depth finders" to measure great ocean depths. An electric oscillator gives out a sound, and a receiving apparatus reminding one somewhat of the elevator indicators in an office building flashes on a light opposite the figure for the depth, when struck by the echo.

The Doppler Effect

If you listen to the whistle of an approaching train, you will find that the tone rises as it approaches, and drops again in pitch as it recedes. The sound-producing whistle comes a little nearer between each two successive waves, so that the waves strike your ear in a little more rapid succession, the frequency becomes greater, and the pitch rises; as the train moves away, the interval between successive waves is slightly increased, the frequency is less, and the pitch is lowered. This is called the *Doppler effect*, from the name of the Austrian physicist who first explained it.

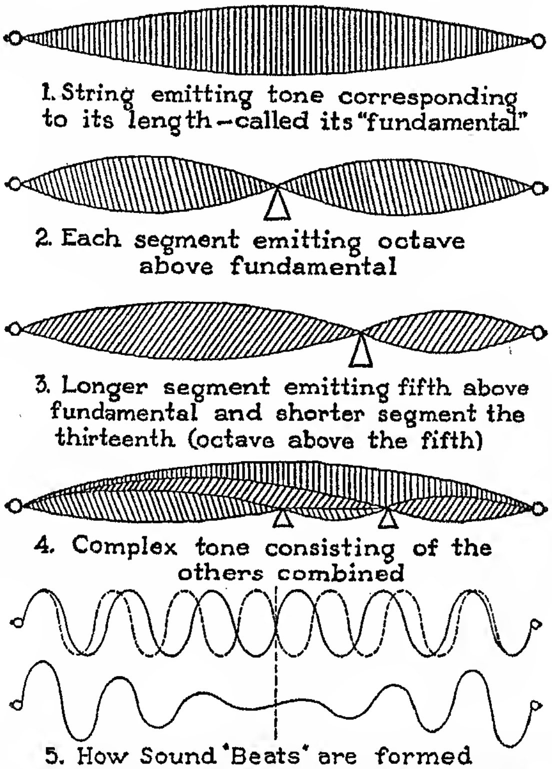
"Interference" and "Beats" in Sound

Sound waves, like light waves, can be refracted and focused, as well as reflected, with suitable apparatus.

Interference effects can also be obtained, giving rise to "silent zones" in certain directions from the source of the sound. Thus, if you happen to be at such a distance from a cliff that the condensation phase of the echoed wave reaches your ears just as a rarefaction wave passes on its way to the cliff, the two, if of equal strength, will cancel each other, and you will hear nothing. At other points, you may hear the two mixed together; or if the distance to the reflecting surface is great enough, the entire original sound may pass before any reflected waves come back, and then you hear the echo clearly.

This interference, or canceling of sounds, is responsible for the "beats" which give a throbbing quality to tone when two similar sources of sound are vibrating at almost the same rate. The accompanying picture shows how the waves alternately reinforce and destroy each other, causing the tone to become alternately louder and fainter. The number of beats is equal to the difference in frequency of the notes.

A VIBRATING STRING AND "BEATS"



At the top is a simple string in vibration, the vibrations being strongest at the center and gradually weaker near the fastened ends. The note which this string gives will always be the same, provided the tension remains constant; this note is called the "fundamental." Other notes are produced on this same string by varying the position of the edged object, and thereby breaking the string into various segments. In no musical instrument, however, has it been possible to keep separate the notes produced by the various segments, but these notes combine, as in No. 4, to produce overtones which give each instrument its peculiar quality. The last picture shows how waves of nearly the same frequency alternately reinforce and weaken each other to give sounds the throbbing quality called "beats." The picture shows two strong beats, one at each end, with the regular pulsations "carrying through" the central weak zone to sustain the tone.

Resonance and Its Results

The fact that most vibrating bodies have a natural "period" in which they tend to vibrate underlies the phenomenon known as *resonance*. The action may be compared to that of setting a swing in motion. If you start it going, and then give a little push each time it reaches the end of a swing, before long it will swing widely.

Likewise feeble air waves of the proper period will set a string or other elastic body to vibrating. You can prove this by humming a note into a piano, meanwhile depressing the loud pedal. Then stop humming, and your note will be given by the proper string, resonance having set it in motion. Empty conch shells also give "the sound of the sea," some sound of proper period having set their columns of air in vibration by resonance. Von Helmholtz (1821–1894) used this principle in his "resonators," hollow metal objects resonant to different pitches, with which he detected the overtones of musical instruments and gave us our modern explanation of tone quality.

The sounding-board of a piano and the body of a violin are added to these instruments to strengthen the tones given by the strings through resonance. In each pipe of an organ, a vibrating jet of air strikes the edge of the opening at the correct frequency to give a tone of the desired pitch; and the tube is of the right length to reinforce the tone by resonance. In wind instruments such as the flute, the length of the resonant column is adjusted by opening holes in the side of the tube (*see* Musical Instruments; Organ).

Fundamentals and Overtones

So far we have assumed that vibrating bodies give off notes of a single frequency. Actually, this rarely happens. Usually we hear a single strong tone, the *fundamental*. Weaker vibrations of higher frequency, called *overtones*, not heard as separate tones, affect the ears nevertheless and give the tone its quality. One combination of overtones, for example, gives the violin its characteristic tone quality; another combination imparts a different quality to the tones of a trumpet, or a trombone, or the human voice.

Musical Tones and "Tempo"

From the earliest times, men have found certain tones, and combinations of tones, pleasing to hear, and used them to produce music. It happens that tones which sound well together always have vibration rates in simple ratios to each other. Thus a note which is an octave above another has twice the vibration rate of the first note.

Modern music employs a system of intervals centering about a note called "middle C," which in natural tone would have a vibration rate of 256 a second. In 1887 an international congress in Vienna adopted an "international pitch," also called "French pitch," giving this note 258⅔ vibrations a second. "Concert pitch," sometimes employed by soloists to increase brilliancy, gives this note 270 vibrations a second. The other tones are fixed at the proper vibration rates to give the intervals used in music.

These intervals are not to be confused with those between *successive* tones, for these intervals fix the *tempo* of the music, not the pitch of its notes. In music, tempo means the number of accents in a measure, and is the principal contributing factor to creating a sense of rhythm. It has nothing to do with the pitch of the individual notes sounded. Tempos are slow enough to be indicated by the *metronome*—a spring-driven, pendulum-like device with a sliding weight which can be adjusted to make the instrument beat any desired number of times a second. The most rapid tempo used (*presto*), as indicated by the metronome mark (M. M. = 208) at the beginning of the composition, is 208 beats a minute—less than one-eleventh of the vibration rate required to produce the lowest audible musical tone.

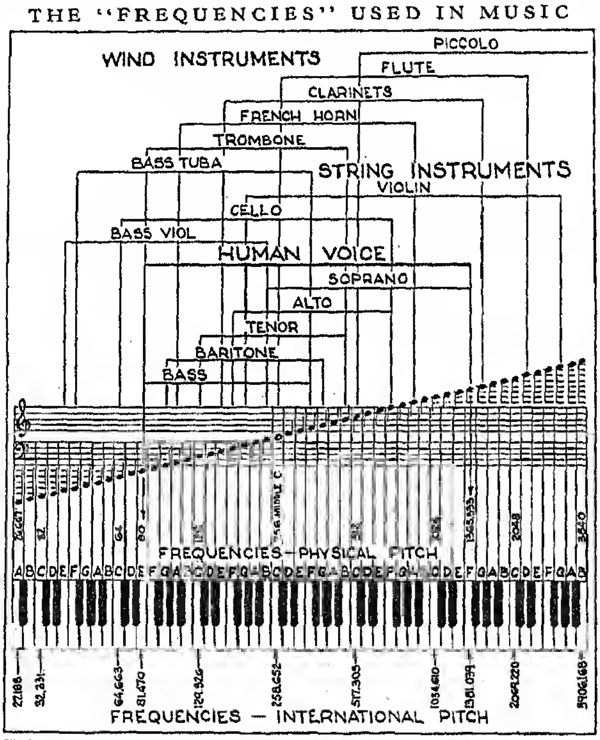
Musical Intervals and the Major Scale

The entire range is divided into octaves, or spans of eight "whole" tones, the top note of the span having twice the vibration rate of the lowest. The six notes between these two have vibration rates in the following ratios to that of the lowest note: 9:8, 5:4, 4:3, 3:2, 5:3, and 15:8. These values are altered slightly in many instruments (*see* Piano). From their position in the octave, the successive notes above the first are often called the second, third, and so on to the eighth, also called "the octave."

Examination of the vibration ratios given will show that the successive intervals are not equal. The intervals between the third and the fourth notes of the scale and between the seventh and eighth, are only about one-half as great as the other intervals. Such an interval is called a half-step. A scale arranged with half-steps at these intervals is called a major scale.

On the piano the instrument is arranged so that striking the white keys in turn from one C to the next higher C sounds the successive notes at the proper intervals. But suppose you try to play a scale starting with G as the first, or fundamental tone. Your first half-step—from B to C—comes correctly, between the third and fourth notes. After you sound E, however, you come to trouble. For your scale, you want a whole step to the seventh, then a half-step to the octave. But the white keys give you a half-step, then a whole step. This difficulty is met by inserting a black key between F and G, which sounds a note midway between F and G in vibration rate. Striking this key enables you to play the scale with correct intervals. The other black keys aid in playing scales based on other notes used as fundamentals (*see* Music). When all the keys in the octave are played, the scale is called *chromatic,* and has no "key" feeling. The "out-of-key" notes also are called chromatics.

THE "FREQUENCIES" USED IN MUSIC



This diagram shows the range in frequencies possessed by well-trained voices and certain instruments, related to the piano keyboard and piano music as written. It also shows for the octave, the vibration rate of its C, both according to strict theory and as adjusted to "international pitch" described in the text.

Minor and Other Scales

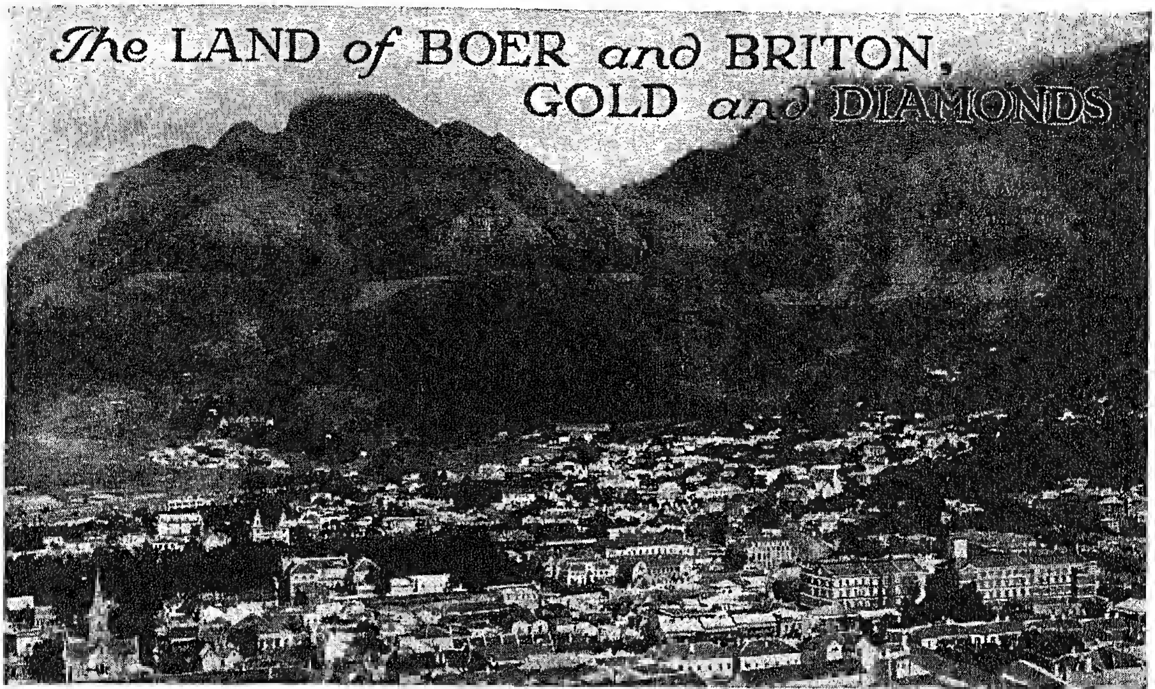
Certain other successions of intervals in scales also give effects pleasing to the ear. Suppose you strike the successive upward notes on a piano, from one A to another, "sharping" the seventh note as you did in playing the major scale of G. Thus your first half-step comes between the second and third notes (making a *minor* third with the fundamental); another comes between the fifth and sixth; there is a one and one-half step interval between the sixth and seventh, and a final half-step between the seventh and octave. This succession of intervals is a *harmonic minor* scale, and it can be played, starting from other notes than A, by using additional black keys at the proper places.

The *melodic* minor scale varies according to whether you play it up or down. Playing upward from A, you would strike black keys between F and G and between G and A, obtaining a full step between the fifth and sixth, then another, and lastly a half-step. Playing downward from A, the white keys alone are used, giving a full step between the octave and seventh, and half-steps between the fifth and sixth, and second and third.

The *pentatonic scale* consists of intervals such as given by striking A, B, D, E, and G on the piano, the intervals being whole steps except for one and one-half steps between the third and fourth notes, and a half-step between the fourth and fifth. It is perhaps the oldest scale known, and savage races use it largely. Modern composers employ it to obtain novel effects. A scale having whole-step intervals only is a whole-tone scale.

Unlike our knowledge of many subjects, founded on epochal discoveries, the science of sound grew detail by detail, commencing with the explanation of fundamental phenomena given by Sir Isaac Newton. Most of the discoveries consisted of successful mathematical analyses of known phenomena, as in the study of vibrating strings by Brook Taylor in 1715 and by Bernoulli in 1755. Bernoulli studied vibrating bars, as did Chladni (1756–1827), while Poisson in 1829 explained the vibrations of membranes. Knowledge of musical tones has been growing since the "vibration ratios" were discovered by Pythagoras in the 6th century B. C.

The LAND of BOER and BRITON, GOLD and DIAMONDS



Cape Town from Lion's Head, Looking across to Table Mountain

SOUTH AFRICA. The story of South Africa is a story of bold explorers and hardy settlers on unfriendly coasts, of battles against pigmy Bushmen using poisoned arrows and against Kaffir and Zulu giants wielding huge shovel-headed spears. It tells of conflicts with wild beasts, of the discovery of gold and diamonds, of the bitter clash of Boer and Briton in the wilderness, of devoted missionaries who carried civilization into desert and jungle, and finally, of peace and prosperity under the British flag.

The land in which this stirring drama was played is shut off from the ocean by ramparts of hills that rise from low-lying coasts step upon step, with barren terraces or "karoos" between. The hills ascend until suddenly the whole vast region opens out into a great plateau from 4,000 to 6,000 feet above the sea, stretching far away to the northward. Here is the treeless grass-covered, rolling "veld," and the rough scrub or "bush," where stunted acacias, dwarf mimosas, and bitter aloes fight for life in the dry soil.

Sheltered from the moist ocean breezes, the climate is bracing and healthful. Game of all kinds was formerly plentiful, and if lions and leopards made travel dangerous, there were numberless antelopes, buffaloes, zebras, and giraffes to provide meat for the hunter. In the more tropical regions along the east coast, the elephant, the hippopotamus, and the rhinoceros are still found sparingly.

South Africa, like America, was found by Europeans of the 15th century who were seeking an ocean highway to the rich commerce of India. Bartholomew Diaz, the Portuguese navigator who discovered the Cape of Good Hope in 1488, and Vasco da Gama, who reached India by that route ten years later, as well as the scores who followed in their wake, looked upon this vast southern projection of the "Dark Continent" merely as something they had to go around on their way to the "land of spices and silk." Indeed, there was little about these barren and harborless shores to attract men whose minds were fixed on the riches of the Far East. The Portuguese who led the way and others who followed them did not even bother to establish temporary stations on these coasts, for they only stopped for wood and water or to repair the damage done by the Cape storms.

This Chapter Begins with a Shipwreck

It took a shipwreck to bring about the first settlement. Dutch sailors, driven ashore in Table Bay, near the Cape of Good Hope, in 1648, were compelled to forage for themselves for several months. Rescued and returned to Holland, they gave such a good account of their discoveries that in 1652 the Dutch East India Company established a fort and a plantation in the shadow of Table Mountain. More settlers followed, and in 1687 a number of French Huguenot families, expelled from France, threw in their lot with the Dutch colonists.

The hardy pioneers of Table Bay soon tired of the petty tyrannies of the Dutch East India Company, which continued to look upon the colony as a mere stopping-off place and trading station. By 1720 the "treks" or migrations began. The hardy pioneers pushed over the northern hills or followed the mountains toward Natal, as the southeast coast had been called by Vasco da Gama, setting themselves up as independent farmers, vine-growers, and cattle-raisers.

In the Cape region the colonists had encountered the Hottentots, a friendly easy-going race of blacks, many of whom were soon enslaved. But as they reached farther into the interior they came upon natives of an entirely different spirit. In the western part of the great plateau lived the Bushmen, a race of dwarfs, averaging less than five feet in height, but shrewd and freedom-loving. The colonists made the mistake of mistreating these tiny people, and the result was that many a white man died an agonizing death from their arrows tipped with the poison of snakes and deadly spiders. The Bushmen were hunted down like wild beasts, but they refused to make peace, and today the scattered remains of this interesting race are living on locusts and roots in the Great Kalahari desert, beyond the Orange River to the north.

Toward the east coast appeared far more formidable foes. They were the Kaffirs, giants in stature, many tribes averaging six feet in height, strong, intelligent, and well organized. Once aroused to the fact that the white men were trying to seize their territory, these Kaffirs hurled themselves upon the intruders with their great assegai spears, whose blades were often 18 inches long and 12 inches wide, and fought with a courage and ferocity never surpassed among savages.

Great Britain and the Boers

Meanwhile the Napoleonic wars in Europe had made Great Britain and Holland enemies, and the British seized Cape Colony in 1795, returned it to the Dutch in 1803, but took it back again in 1806. Finally in 1814, Holland, for $27,000,000, surrendered all claim upon Cape Colony.

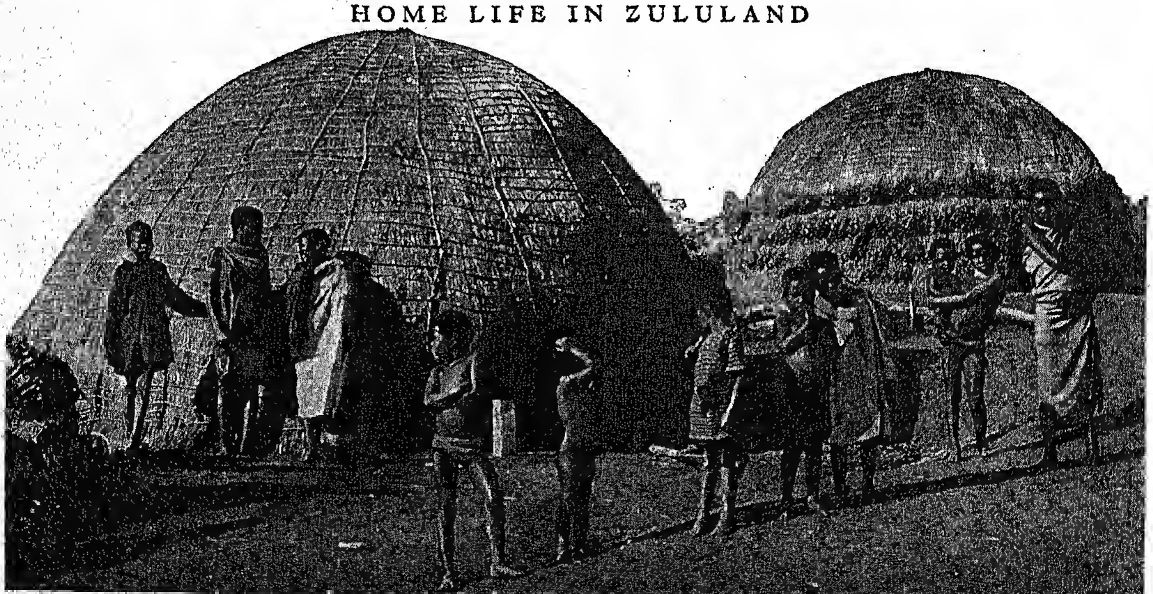
There were at that time in the Cape region, about 27,000 "Boer" settlers, as the colonists of Dutch descent were called from the Dutch word for "farmer." Most of them strongly objected to their new rulers. Great Britain in 1820 settled 4,000 of her own citizens in the colony, and British missionaries soon began interfering with the harsh treatment of the natives by the Boers. Finally, in 1834, slavery was abolished by a general law of the British Parliament, and bitter resentment spread among the Boers.

In 1836 began the "Great Trek," when 7,000 Boers emigrated from Cape Colony into the great plains beyond the Orange River, and across into Natal, and even beyond the Vaal River into the Transvaal. There these farmers and cattle-raisers set up independent republics. In Natal they failed, for this province had been colonized some years before by the British, and it was officially declared a colony of Great Britain in 1843.

After recognizing the independence of the Transvaal in 1852, the British attempted to annex it in 1877, partly on the ground of internal anarchy and the danger from the formidable military power of the Zulu chief Cetewayo, and partly to aid the federation of all South Africa into a single British dominion. Three years later the Boers took up arms in rebellion. On Feb. 27, 1881, they administered a severe defeat to the British forces at Majuba Hill, killing the general in command. Thereupon Gladstone, who had now become prime minister, withdrew the British claims to the Transvaal, and the Boers regained self-government under British suzerainty.

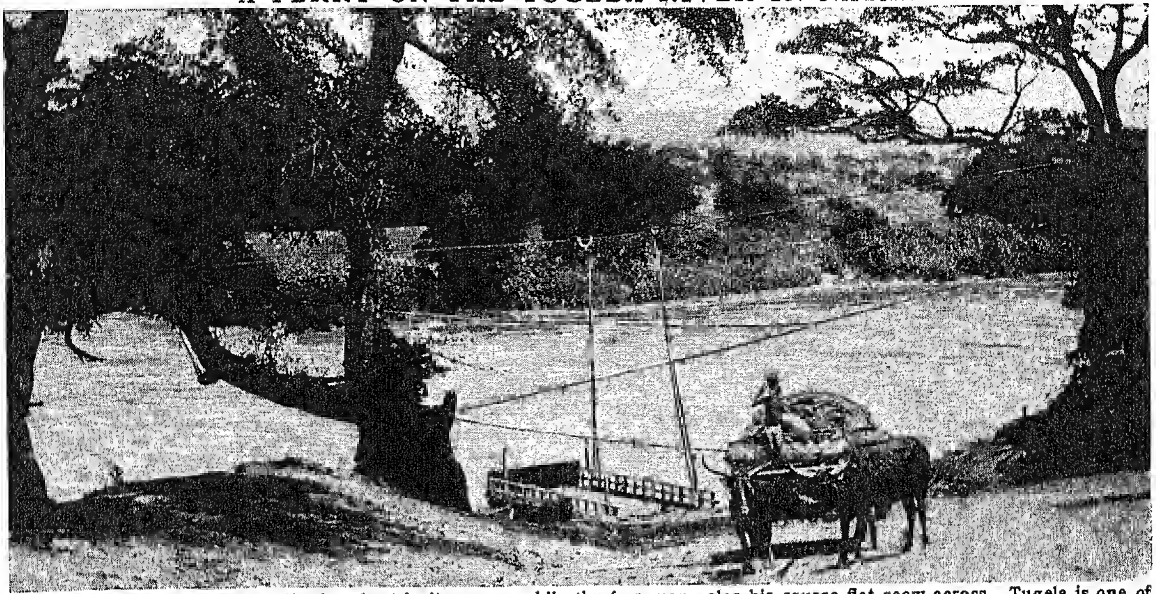
Meanwhile the British in 1879 had fought and conquered King Cetewayo and his trained army of 40,000 Zulus, who charged in the face of the white man's rifles with all the discipline and drill of European troops. The conflict shook the foundations of the

HOME LIFE IN ZULULAND



The homes of the Zulus are in a semi-tropical region, where clothes are a luxury and adornment rather than a necessity. Their houses, which look like beehives, are built of a framework of poles covered with thatch. A Zulu village or *kraal* is circular in form, the huts being grouped around a central open space, in which are kept the most valuable possessions of the tribe—the cattle.

A FERRY ON THE TUGELA RIVER IN NATAL



A cable over the stream keeps the ferryboat in its course while the ferryman poles his square flat scow across. Tugela is one of the short rapid rivers which rise in the Drakensberg and flow east into the Indian Ocean. Eight miles north of the Tugela is Ladysmith, which was besieged during the Boer War. Their attempts to relieve that town cost the British three serious defeats before they could effect a crossing of the river.

British rule in South Africa and makes one of the most thrilling chapters in the history of this region; but in the end the British were victorious and the Zulu military system was broken up.

Peace between the Boers and the British might have continued but for two important events. The famous Kimberley diamond fields were discovered on the western border of the Orange Free State in 1869, and in 1886 came the discovery of the rich gold fields of the Witwatersrand in the Transvaal. This became the richest and most productive gold field in the world. Into these Dutch territories rushed adventurers from all parts of the world, especially from Cape Colony and England.

Clash between Old and New

Thriving industrial centers suddenly grew up in the midst of the wilderness, at Kimberley, at Johannesburg, and at a score of other places. Pretoria, now capital of the Union of South Africa, which is near Johannesburg, and Bloemfontein, now capital of the Orange Free State, which is near Kimberley, shared in the prosperity of the mining centers. Railroads were built to the coasts to carry out the new-found wealth, and to bring in supplies. The coastal towns of Port Elizabeth, East London, Durban, and Capetown suddenly found themselves important ports and trading centers. The energetic progressive settlements of "uitlanders" (outlanders), eager for the advantages of modern civilization, were surrounded on all sides by the stubbornly old-fashioned Boers, who

JOHANNESBURG, GOLD-MINING CENTER

Johannesburg is the largest city in South Africa, with a population of about 520,000. The modern city is flanked by the fabulously rich Witwatersrand ("White Waters Ridge"), known simply as the Rand. In the distance we see the white dumps of the famous gold mines.

were opposed to change and asked only to be allowed to continue their free life of patriarchal simplicity on the open veld. A clash between the old and the new was inevitable.

Meanwhile the commanding figure of Cecil Rhodes appeared in South African politics (*see* Rhodes, Cecil), with his dream of a great empire under British rule extending northward into Central Africa. To counteract these revolutionizing tendencies the Boers, under President Paul Kruger of the Transvaal—who believed to the end of his days that the earth is flat—organized anti-British sentiment into the "Afrikander Bond"—Afrikander being the term applied to white men of Dutch descent who had been born in South Africa. The Bond encouraged hostility to all "uitlanders," as the new settlers were called.

Rhodes, who had earlier established British authority over that vast central portion of South Africa northwest of the Transvaal known as Bechuanaland, now organized the British South Africa Company, which took over Mashonaland in 1890 and conquered Matabeleland from the native chiefs three years later. These regions, called today Southern Rhodesia, lie between the Limpopo River, the Zambezi River, and Portuguese East Africa. The Boers were now hemmed in.

For their part, the "uitlanders" on the "Rand," the Johannesburg gold district, complained bitterly against the laws of the Transvaal Boers, which discriminated against them in many ways and made it virtually impossible for any foreigner to obtain any voice in affairs. Then Joseph Chamberlain became British colonial secretary; aided by Rhodes, he supported the British claims to the utmost.

In 1895 occurred the ill-fated raid on the Transvaal, led by Dr. Leander Jameson, and the wave of bitterness it aroused rapidly hurried the Transvaal and the Orange Free State into war with Great Britain. Hostilities broke out in October 1899, and though the British were in the end victorious, it was only after three years of hard fighting, in which nearly half a million men were sent from the mother country and its colonies to South Africa. (*See* Boer War.)

A VAST LAND OF VELDT, MOUNTAINS, DESERT AND FOREST

The mountain ridges which skirt the eastern coast of South Africa capture the moisture of the ocean breezes, leaving the interior and the west coast arid. Yet this land hides untold riches, the central portion being little known except to a few explorers and hunters. With the exception of the two Portuguese colonies of Angola and Mozambique, and that fragment of the Belgian Congo, all the territory shown here is under British control.

Out of this conflict came a period of reconstruction and the gradual growth of friendly feeling. This culminated first in the grant of self-government to the Boers in 1906, and finally in the formation of the Union of South Africa, in 1909, which included the provinces of the Cape of Good Hope, Natal, the Transvaal, and the Orange Free State. The Union was given self-government under a governor-general appointed by the British crown. Never before in

history was a conquered people so generously admitted in so short a time to full participation in the government. This happy result was largely due to the loyalty and statesmanship of the Boer leaders Botha and Smuts (*see* Botha, Louis; Smuts, Jan).

The Union Today

The Union of South Africa is a self-governing dominion of the British Commonwealth of Nations. The four provinces of Natal, Transvaal, Orange Free State, and Cape of Good Hope have a total area of 472,550 square miles, and a population of 9,589,898. The natives number more than 7,000,000, most of them Bantu. About 200,000 East Indians are concentrated around Durban and Pietermaritzburg, where they are occupied in market gardening and retail trade.

The capital is Pretoria, but the legislature meets at Capetown. The official languages are English and Afrikaans, or Taal, the Dutch tongue as spoken in South Africa after generations of separation from the mother country.

Elementary education is directed by the individual provinces. It is free and compulsory, with separate schools for European and non-European children. All higher education is controlled by the Union Department of Education. There are five universities—Capetown, Stellenbosch, Witwatersrand, Pretoria, and South Africa.

SOUTH AFRICAN NEGROES

At the top is one of the brown-skinned Bushmen, considered the least developed members of the Negro race, and below a Zulu warrior, energetic and intelligent.

Natural Resources and Manufacturing

South Africa is primarily a grazing country, comparable in extent and general characteristics to the three states of Texas, New Mexico, and Arizona. It raises five times as many sheep as the corresponding area in the United States, and approximately the same number of cattle. This is one of the principal wool-producing countries of the world; wool exports are second to gold in value. It also exports mohair, butter, and cheese.

Only 5 per cent of the land is in crops. Corn is the leading field crop. It is a major item in the diet of the natives, and also enters into the export trade. The Union grows enough wheat for its own consumption, nearly all of it near Capetown. Sugar cane, tobacco, and cotton are also raised.

The extreme southern tip around Capetown is an important fruit-growing area. Grapes occupy the largest acreage. Most of this crop is used in making wines and brandies. Citrus fruits are grown near Port Elizabeth and in northern Transvaal. Dried and fresh fruits are exported in large quantities.

Minerals are the greatest source of wealth. Between one-third and one-half of the world's annual supply of gold comes from the Union of South Africa, chiefly from the Rand in Transvaal. Diamonds from the Kimberley and Pretoria fields are second in value among minerals. Coal deposits in Natal and Transvaal are the only fuel the country possesses in large quantity. Petroleum is lacking, and sources of hydroelectric power are limited. Copper, iron, and platinum are abundant in the Transvaal. Tin, lead, manganese, chrome, asbestos, and other minerals are in production.

The transportation system is state-owned and state-managed. It embraces railways, harbors, steamships, airways, and motor highways. Where the country is too thinly populated to warrant the building of railroads, the state has established motor services.

The first World War gave an impetus to small industries supplying the local market, such as tobacco manufactures, machinery, chemicals, clothing, boots and shoes, vehicles, and furniture. The second World War saw the birth of heavy industry, based on the coal and iron of the Transvaal. The first steel works had opened in Pretoria in 1934. It was subsidized by the government. The Electricity Supply Commission ("Escom"), also government subsidized, had established a great system of electric power plants. These plants enabled the country to turn to large-scale production of war supplies—munitions, armored cars, and other products. The first textile mills were built at this time.

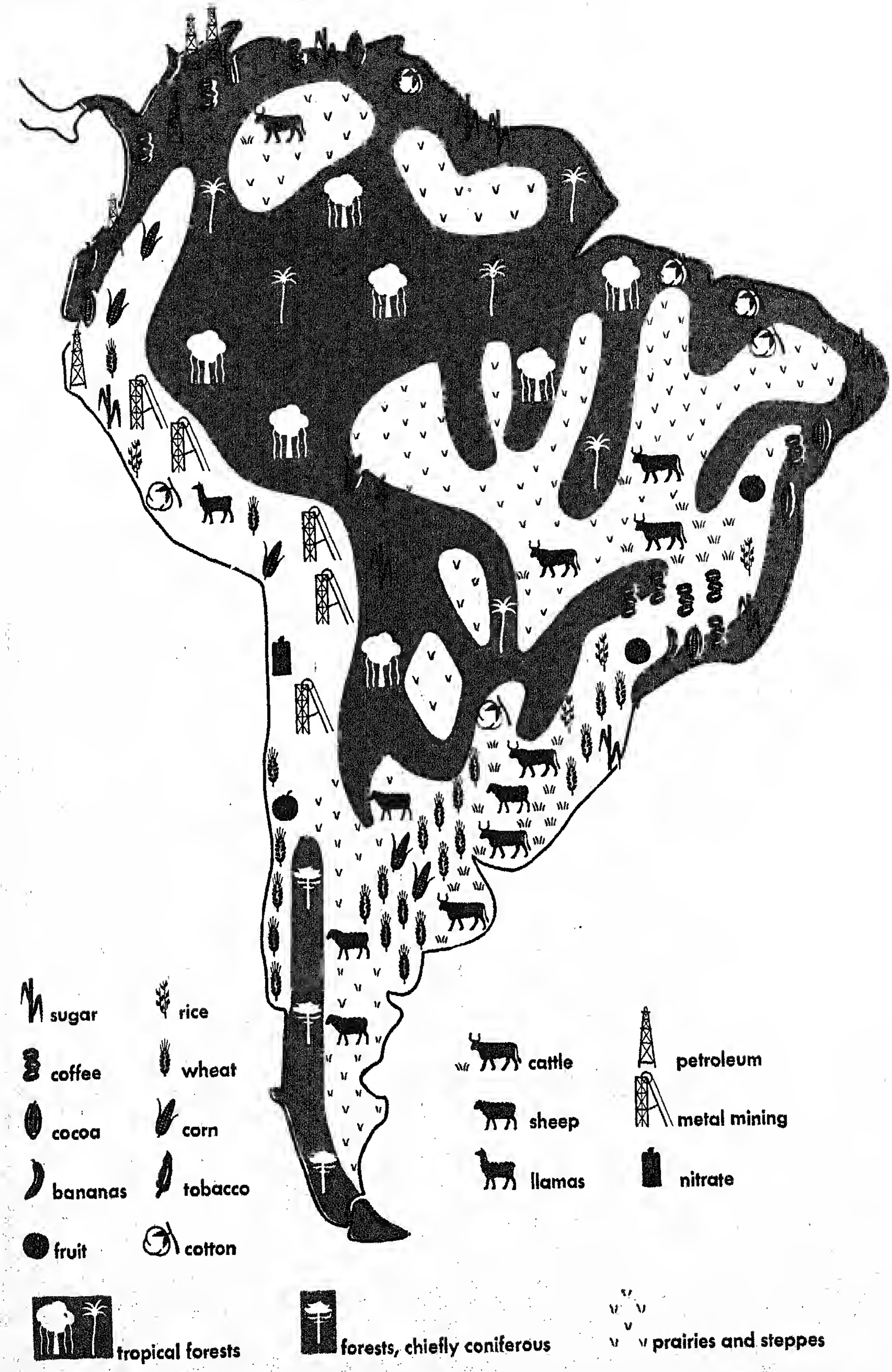
The Union gave Great Britain full support under the leadership of Prime Minister Smuts. The South African Air Force played an important part in the campaigns in Libya and Ethiopia, and Union troops were sent to all parts of the empire.

Other South African Territories

The Union exercises a protectorate over the Territory of Southwest Africa, a region of 317,725 square miles. Stock-raising is the chief occupation, and it is capable of considerable agricultural development. It has a rich diamond field and a variety of other minerals.

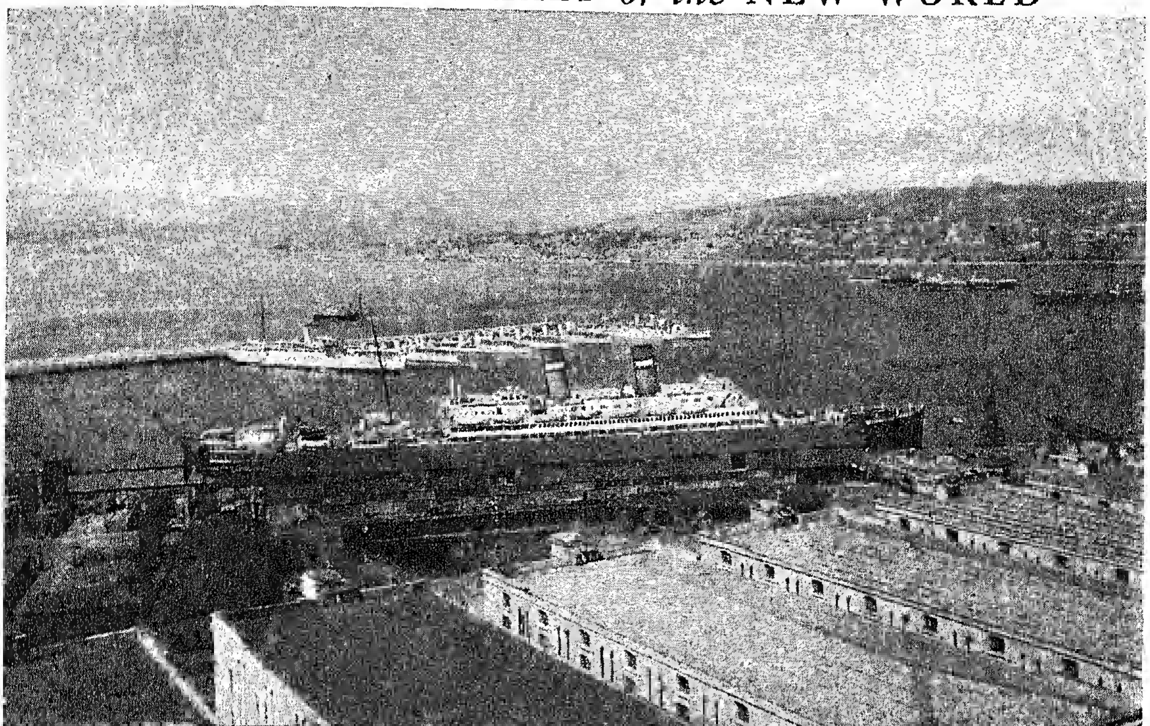
Geographically, South Africa also includes the British territories of Basutoland, Bechuanaland, Swaziland, Southern Rhodesia, and southern Mozambique (*see* Mozambique). The best grain lands in South Africa are in little Basutoland, as well as excellent pasturage for cattle and sheep. Bechuanaland is pastoral, and Swaziland provides winter grazing for flocks of sheep from the Transvaal. Southern Rhodesia is rich in minerals and timber. It is well suited for agriculture, especially dairying and citrus-fruit culture.

South America Use of Land



Prepared for Compton's Pictured Encyclopedia

The SOUTHERN HALF *of the* NEW WORLD



Valparaiso, "Pearl of the South Pacific"—South America's Finest West Coast Port

SOUTH AMERICA. The traveler who goes from the United States or Canada to South America finds scenes and people strikingly different from those of his own land. He sees mountains far higher than the Rockies and rivers immensely greater than the Mississippi or the St. Lawrence. He gets glimpses of rain-drenched tropical forests larger than the entire United States. In the western mountains he observes strange woolly animals of the camel family, called llamas, carrying goods over narrow winding trails. In the Amazon forest he may see enormous snakes 20 feet long, butterflies a foot across, beetles six inches long, sloths that live upside down in the trees, chattering monkeys, gorgeously colored parrots, and a host of other unfamiliar animals.

Extent.—Greatest length, from Cape Gallinas (Colombia) to Cape Horn, about 4,600 miles; greatest width, from Cape Branco (Brazil) east to Point Pariña (Peru), about 3,200 miles. Area, variously estimated at from 7,200,000 square miles to 7,310,800 square miles. Population, estimated at about 90,000,000.

Highlands, Lowlands, and Waterways.—Cordilleras in north and west (Aconcagua, 22,834 feet); Guiana Highlands, Brazilian Highlands, Patagonian Plateau, in west. Orinoco, Amazon, and Paraguay-Paraná river basins. Largest lake, Titicaca (3,800 square miles).

Political Divisions and Capitals.—Republics: Argentina (Buenos Aires), Bolivia (Sucre and La Paz), Brazil (Rio de Janeiro), Chile (Santiago), Colombia (Bogotá), Ecuador (Quito), Paraguay (Asunción), Peru (Lima), Uruguay (Montevideo), Venezuela (Carácas). Colonies of European nations: British Guiana (Georgetown), Dutch Guiana, or Surinam (Paramaribo), French Guiana (Cayenne).

Chief Islands.—Falklands (occupied by Great Britain but claimed by Argentina), Tierra del Fuego (Argentina and Chile), Chilean Archipelago, Juan Fernandez (Chile), Galápagos (Ecuador), Curaçao and Aruba (Netherlands), Trinidad and Tobago (Great Britain), Cayenne (France).

Chief Exports.—Wheat, corn, flaxseed, coffee, cacao, tobacco, cotton; meat, wool, hides and skins; quebracho, vegetable ivory and other nuts, carnauba wax, rubber, balata, cabinet woods; petroleum, copper, tin, nitrate, silver, gold, diamonds, emeralds.

Other Products.—Oats, barley, rice, beans, potatoes, manioc, fruits, sugar, *yerba maté;* flour, petroleum products, textiles and clothing, hats, shoes, lumber and furniture, cigarettes, cement, glass, pottery, soap, matches.

Imports.—Iron and steel manufactures, machinery, railroad and mining equipment, agricultural implements and machinery, automobiles and trucks, lumber, petroleum, coal, textiles and clothing, radios and other electrical equipment, prepared foods and beverages, sewing machines and other household equipment.

He will be struck too by differences in the people and their ways of living. Indians or people of part-Indian blood are almost everywhere, greatly outnumbering the whites. In Brazil there are fewer Indians, but more Negroes. The white people too are different from the typical inhabitants of the United States and Canada. They speak Spanish, except in Brazil, where the language is Portuguese; and most of them have olive complexions and black hair.

The magnificent cities, with their cosmopolitan architecture, look more like the great cities of the Old World than of the New. Splendid public buildings in the Spanish style, wide tree-lined central avenues, parks, and plazas ablaze with flowers—these remind one of European cities. Here and there are skyscrapers telling of North American influence. Houses of the well-to-do are built around a central patio (courtyard), as in Spain; but apartment houses of modern design are rapidly springing up to house those with smaller incomes.

The traveler observes, though, that in the entire continent there are few cities, in comparison with

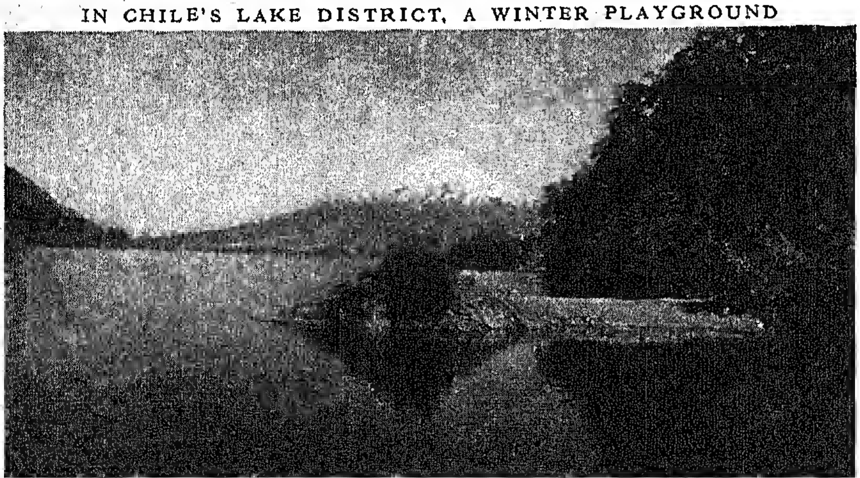
the United States. These cities, large as a few of them are, have only a small fraction of the entire population, whereas more than half of the people of the United States live in cities. He also learns that more than two-thirds of the people of South America depend on agriculture for their living, whereas in the United States less than a quarter of the people live on farms.

As he travels inland from the various seaports, the visitor notices other great differences. There are few small farms. Most of the agricultural lands are divided into vast estates (*haciendas* or *estancias*) covering thousands of acres, or even hundreds of square miles. Except in Argentina, Uruguay, and part of Brazil, there are no great railway networks to make it easy for the people to travel and transport goods. Motor roads are few and short, compared to those of the United States; and motor transport outside the great cities is in its infancy. When the South American businessman wants to visit a neighboring country, he probably travels by air, since all the capitals are linked by excellent airplane service.

South America is a continent of vast resources and opportunities which no one can reckon. It has given mankind potatoes, rubber, quinine, and many other useful plant products. It supplies most of the world's coffee, and a large part of the meat, wheat, corn, and cacao that enter into world trade. Its minerals have enriched nations for four centuries. The world relies on this continent for a considerable proportion of its petroleum, nitrates, tin ore, aluminum ore (bauxite), copper, manganese, and industrial diamonds. (*See* pictograph on page 204.)

Yet the development of South America has scarcely begun. It has room for millions of people from overcrowded parts of the earth. It has millions of acres of potential crop and pasture land to be occupied. Buried in its rocks is a wealth of minerals still to be discovered and worked. Its forest resources have hardly been touched.

IN CHILE'S LAKE DISTRICT, A WINTER PLAYGROUND



The old snow-crowned Osorno volcano, rising from the emerald waters of Lake Llanquihe, is one of the favorite skiing grounds of Chileans. It is about 600 miles south of Santiago.

Can these possibilities be realized? Or are the obstacles of climate, mountain, jungle, and human character so great that we can look for no remarkable advances, at least in the near future? These are questions that the world is asking. Before we can attempt to answer them, we must know something of the physical setting of the continent, its climates, its plants and animal life, its peoples, its commerce, and its history.

Physical Setting: Comparison with North America

In shape and size, South America is much like its sister continent. It is a vast triangle, broad in the north and tapering to a narrow tip in the south. It extends about 4,600 miles from north to south and 3,200 miles from east to west, against 4,500 miles and 3,000 miles respectively for North America. In area it is smaller by about an eighth.

In general ground plan as well, the two continents are somewhat alike. Both have great ranges of high young mountains in the west. Both have extensive areas of old worn-down mountains in the east. And both have vast interior plains drained by great river systems. But the South American coast line is far more regular. Around much of the continent the mountains rise abruptly from the sea, with few good harbors, and little or no coastal plain to invite settlers. The interior plains are mostly tropical forest, and the western mountains are higher and more rugged than the western mountains of North America.

The Great Barrier —the Andes

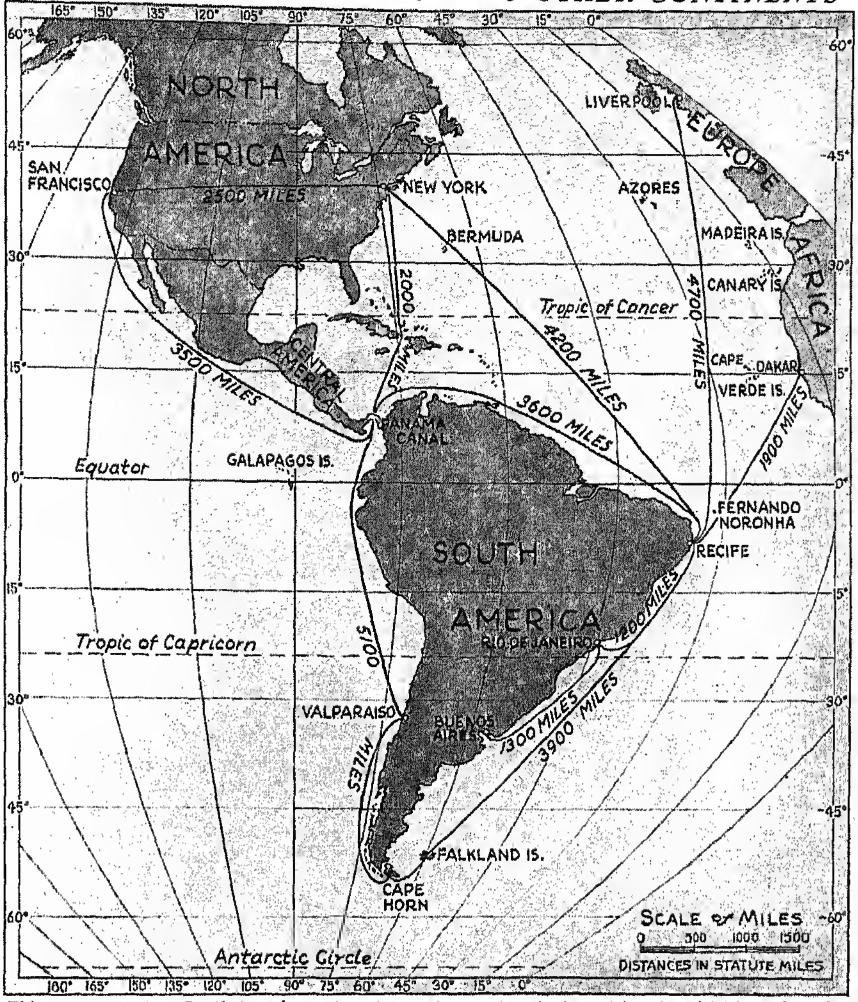
The Andes are the most formidable mountain barrier on the globe. Though they are not so high as the Himalayas, they constitute a greater obstacle because they stretch for a total distance of 4,500 miles. They are a far more difficult barrier than the Rockies of North America, for two reasons. First, they climb steeply from the Pacific on the west and from the interior lowlands on the east. Second, they are much higher than the Rockies. Throughout most of their length, even the passes, valleys, and plateaus are almost as high as the tallest peaks of the Rockies. Railroads in the Andes are tremendously expensive to build and operate. Only the most necessary lines can be built to serve capital cities and the richest mining districts.

Thus the Andes cut South America into two almost completely isolated sections. Here is an example of what this means. The seacoast of Ecuador is in one

place only about 200 miles from a branch of the Amazon. But goods can be shipped several thousand miles around by sea to the mouth of the Amazon, and then up the river, at less cost and in less time than would be needed to send the shipment 200 miles over the mountains. Life in the two portions of South America has therefore developed almost as though South America were two continents.

But the greatest point of difference between the two continents, and the one which explains most of their other contrasts in plant life, animal life, and human activity, is their position with regard to the Equator. The widest part of North America and about three-fourths of its area lie in the middle latitudes, far north of the Equator. But the broadest part of South America is near the Equator, and three-fourths of its area lies within the tropics. Three-fourths of North America feels the stimulating effects of a climate favorable to human activity. In three-fourths of South America human activity is slowed down by tropical heat and white men find it hard to live. This is one of the reasons why it has only about half as many people as North America.

SOUTH AMERICA'S RELATIONS TO OTHER CONTINENTS



This map shows how South America makes the southern point of a huge triangle, with North America to the northwest and northern Africa and Europe to the northeast. Notice that nearly all of South America is east of the 75th meridian of longitude, which passes near New York City and that its eastern tip is only 1,900 miles from Africa. All ports on the east coast, south of Recife, are about equally distant from western Europe and the North Atlantic ports of the United States.

Influence of the Physical Setting on Human Life

THE PEOPLE of South America and their ways of living contrast just as sharply with those of the United States and Canada as do the land and the climate. North of the Rio Grande the white men have taken over the entire continent from the Indians and pushed most of the few remaining Indians into reservations. In South America Indians and *mestizos* (people of mixed Indian and white blood) far outnumber the whites. Except for a few tribes living in primitive communities, the Indians get their living by working for the white people. They till the soil, tend the stock, work on the plantations, dig the minerals, and build the roads and railways. Where roads and railways are lacking they transport unbelievably large loads on their own backs or drive the trains of pack animals.

Much of this difference in the character of the population is due to the contrasting opportunities offered to white settlers by the two continents. In North America, many fine harbors and rivers gave access to a land much like northwestern Europe in climate and suitability for agricultural use. When it was cleared of trees, it made farming land that people from northwestern Europe knew how to work. These conditions attracted humbler folk such as farmers, sailors, and fishermen; and the governments in the homelands encouraged settlers of this kind to come with their families.

When white men first discovered South America, the most alluring sources of wealth were deposits of gold and silver in the high mountains of Peru and Chile

SOUTH AMERICAN TEA

Yerba maté is the favorite beverage of many Latin Americans. The powdered herb is steeped in hot water in a gourd (*maté*) and drunk through a tube called a *bombilla*.

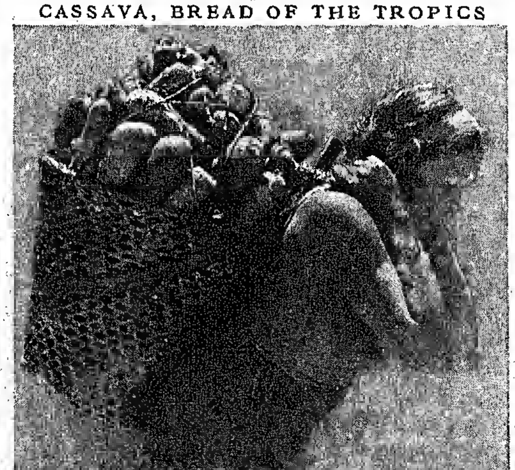
near the west coast. The Indians who were already in the land knew how to work the mines, and how to produce food, clothing, and other necessities for the miners. The Spaniards therefore enslaved the Indians to do all this, and the opportunities for white men were correspondingly limited.

On the Caribbean coast and in Brazil, a similar condition grew out of the hot wet climate. Such a climate is not favorable for white men working their own land; but the land could be worked profitably with Negro slaves. So African slaves were brought in; and here too opportunities for white workers were limited.

White, Indian, and Mestizo Countries

The country where the Indians make up the smallest fraction of the population lies in the grasslands of the south. Here, in Argentina, the whites found a climate and a soil which stimulate effort. Hence, when European demand for Argentine grain and meat arose in the 19th century, the whites pushed the Indians aside and seized the opportunities for themselves. When growth of business created a demand for more labor, they preferred to meet the demand by admitting white immigrants, particularly from Italy. Thus Argentina became the South American country which most resembles the United States in being peopled largely by whites. Uruguay too, with its fine climate and ranching land, has become a white man's country, though Indians are still numerous in the subtropical northern and northeastern portions. Brazil also has attracted white settlers, especially in the southeastern portion; but the white population makes up only about half of the total.

CASSAVA, BREAD OF THE TROPICS



The roots of the cassava or manioc are the chief crop of the natives in the hotter parts of South America. The bitter variety, which is the more common, contains a poison which must be extracted before it is made into flour.

In all the other countries the Indian and mestizo elements greatly outnumber the white. Colombia, Venezuela, Paraguay, and Chile are classed as predominantly mestizo. In Ecuador, Peru, and Bolivia, the Indian population is the most important factor. The exact percentages of Indian, mestizo, Negro, and pure-blooded white elements are not known, for existing statistics are incomplete and unreliable.

Structure of the Land and the Main Forces that Shape the Climate

Some of the larger differences between the regions of South America have already been suggested. To understand these, and the many smaller differences, it is necessary to look more carefully at the structure of the land and at its many different types of climate.

COCA LEAVES

Everywhere in the highlands of Peru and Bolivia the Indians constantly chew the leaves of the coca shrub as a stimulant.

South America began in the early days of the earth as a chain of great mountain islands. They stretched from what is now the Caribbean Sea to Cape Horn. The northernmost of these old islands still hold their summits well above sea level, as the highlands of Guiana and Brazil. The third, far to the south, is the Patagonian Plateau, which occupies the continent's southern tip.

Later in the history of the earth, after the Rocky Mountains of North America had been formed, some vast convulsion pushed up a towering range of mountains far to the west and north of the old islands. This range is the Andes, which swings in a huge bend running first southwest, then southeast, and finally straight south to the tip of the continent. Material washed down from these mountains has since built a sloping plain out to the Atlantic Ocean between the old mountain islands.

The Rivers and the Coast Line

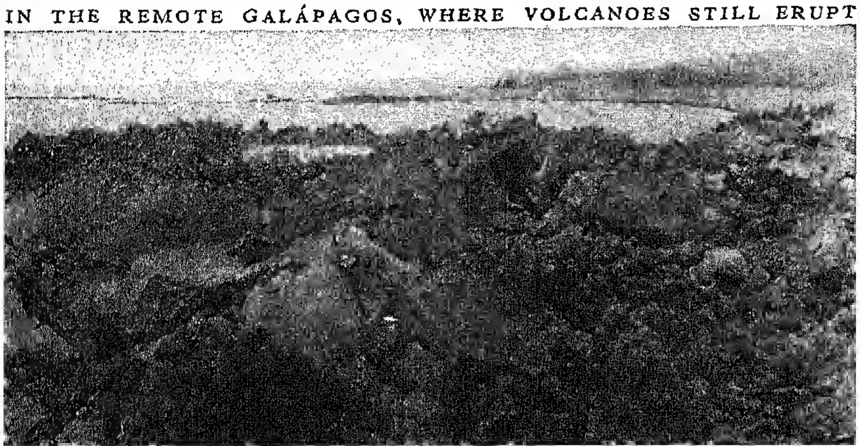
The fact that most of the continent slopes east from the Andes to the Atlantic explains why all the large rivers flow into the Atlantic. And the existence of the old highlands explains why the river systems are organized as they are. The rivers flow along the lowest land they can find, which is between the highland groups. Since only three major gaps of this sort exist, most of the drainage combines into three major river systems. These systems flow into the Atlantic through the Orinoco, the Amazon, and the Rio

Both these views show regions near the Equator. But the upper one is in the barren mountain spurs of the Coastal Desert on the Pacific side. The lower one is in the tropical forest of the Amazon, where plants grow so thick that men have to chop their way through. The view at the top shows the Great Wall of Peru, described on page 206c.

de la Plata (Plata River). Ninety per cent of the continent drains to the Atlantic.

The character of the coasts is fixed most of all by the fact that South America in general has been tilting slightly, century by century, upward in the north and downward in the south. Along the north half of the Pacific coast this steady rising has brought the mountains up sharply from sea level, leaving a straight and almost harborless coast line. A further reason for the lack of harbors is the fact that along most of this coast very little rain falls. Hence there are no strong river currents to cut valleys down to sea level and thus form bays.

IN THE REMOTE GALÁPAGOS, WHERE VOLCANOES STILL ERUPT



This lava field on Albemarle Island, largest of the Galápagos Islands, was formed by the eruption of 1925. The group, which contains 12 main islands, lies on the Equator about 600 miles west of Ecuador, to which it belongs. It is famous for its giant lizards and tortoises.

Vessels must lie in open water and send passengers and cargo ashore in small boats called *lighters*, except where breakwaters and piers have been built into the open ocean. The only exception is at Guayaquil in Ecuador. Here a small river mouth and an offshore island combine to provide a good natural harbor.

Similarly along the Caribbean coast and the northern half of the Atlantic coast, the land presents an all but unbroken front to the sea for more than 2,000 miles. The only breaks are the mouths of large rivers, and a few bays.

In the south, where the land is sinking, these conditions are reversed. The gently sloping Atlantic coast is scalloped with shallow bays where the sea is invading the lower portions. On the mountainous Pacific coast, the narrow Chilean valleys have become fiords and sounds. Valparaiso, Chile's chief seaport, is on a deep bay. In the far south, the mountains of the Coastal Range have sunk until their tops now are islands—the Chilean Archipelago.

Islands of South America

At the extreme south the sea has cut completely across the continent in the Strait of Magellan, making the tip a great archipelago, Tierra del Fuego.

Aside from these southern groups, South America has few islands. Off the northern coast, the peaks of submerged mountains appear above the ocean level as Trinidad and the Curaçao group. On the Pacific side the only considerable islands are the Galápagos (Archipelago de Colón) on the Equator west of Ecuador, and the Juan Fernandez Islands of Chile west of Valparaiso. In the southern Atlantic, 300 miles east of the Strait of Magellan, are the Falkland Islands. Like Tierra del Fuego, these islands were once a part of the South American mainland.

General Character of the Climate

Everywhere the North American tourist feels that he is in a climate very different from his own. Three-fourths of South America is within the tropics. This part of the continent is hot the year round, with a tremendous rainfall, except where the mountains rise to cooler regions. Near the Equator one may climb in a few hours from intense heat to almost Arctic cold. But whatever the prevailing temperature may be at the various levels in these tropical regions, it varies little from season to season. "Summer" and "winter" are much alike, except in the amount of rainfall.

Farther south, in the middle latitudes of Argentina and Chile, there are climates more like those of the United States and Canada. But here the continent is so narrow that temperature is modified by the nearness of the oceans. Nowhere does one find a continental climate with great differences between summer and winter. Even in northwestern Argentina, where the difference is greatest, it is only about 30°. In general, too, the difference between day and night temperatures is far less than it is in the northern part of America. Thus in most parts of the southern continent, one misses the invigorating effects of a changeable climate with great differences between day and night, summer and winter.

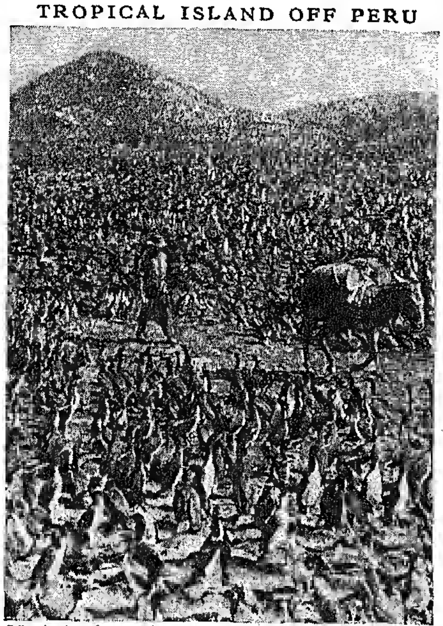
Since most of South America lies south of the Equator, the seasons are opposite to those of North America. When the Northern Hemisphere shivers in the grip of winter, the sun is near the Tropic of Capricorn in the Southern Hemisphere, and most of South America has summer. When summer comes to the Northern Hemisphere, the sun is near the Tropic of Cancer and most of South America has its winter. Our poetic line, "What is so rare as a day in June," about fine summer weather would seem all wrong in Argentina or Chile. There the line should read, "What is so rare as a day in December."

Great Variety of South American Climates

Because of its extent through 63° of latitude, and because of the mountains and ocean currents,

South America has many climates. They range from the perpetual heat and rain of the equatorial forests to the hot arid plains of western Argentina and the Arctic cold of the high Andes. Between these extremes are the mild and pleasant climates of Chile's Central Valley, Argentina's Pampa, and Brazil's coffee-growing highlands.

TROPICAL ISLAND OFF PERU



Myriads of sea birds nest on the scores of islands that fringe the coast of Peru. Their guano was once Peru's chief source of wealth.

These climates fall into four great belts: (1) the region of equatorial heat and heavy rainfall across the broadest part of the continent; (2) and (3) the belts of trade winds to the north and south of the equatorial region; (4) the belt of westerly winds in the middle latitudes of the south (*see* Climate; Weather Bureau; Winds).

But temperature and precipitation do not depend solely on distance from the Equator and situation with respect to prevailing winds. Another important climate-making factor in South America is the tremendous barrier of the Andes.

Effect of Mountains and Highlands

In ascending these mountains, one finds constantly decreasing temperatures. In tropical latitudes, for every 300 feet of elevation there is usually a drop of about one degree of temperature. People often suffer from cold in Quito, which is almost on the Equator but at a height of about 9,000 feet. So abrupt are the changes of climate at various levels that in La Paz one household servant may be sent in the morning to the heights above for a load of ice and another to lower levels for tropical fruits, both returning at noon with their contrasting burdens.

Similar variations in temperature are produced by the Guiana and Brazilian highlands in the east of the continent. In the south central part of the Brazilian Highlands, where the elevation is between 2,000 and 4,000 feet, temperatures average seven or eight degrees lower the year round than they do at sea level in the same latitudes.

The mountains and highlands also largely determine where rain will fall, and how much. Over the tropical part of the continent east of the Andes, much of the supply of moisture is brought from the Caribbean Sea and the Atlantic by the trade winds from the northeast and the southeast. These winds discharge most of their moisture as they climb the slopes of the Guiana and the Brazilian highlands. Nearly all the rest of their moisture is precipitated upon the basin of the Amazon and on the eastern slope of the Andes. Only a small amount reaches the summits of the mountains, where it falls as snow. All the continent west of the mountain crests is, in general, cut off from the Atlantic winds. This is one of the reasons why most of the tropical portion of the Pacific Coast gets no rain, except for light drizzles from fogs and rare downpours every few years. The only wet part of this coast is in the north, where tropical showers bring heavy rainfall every month and almost every day.

In the middle latitudes to the south, this east-west arrangement of wet and dry regions is reversed. Here the moisture-bearing winds come from the Pacific, and they drop almost all of their moisture on the western slopes of the Andes. Southern Argentina would be a desert if these winds, after passing over the mountains, did not set up cyclonic storms which draw in some moisture from the South Atlantic.

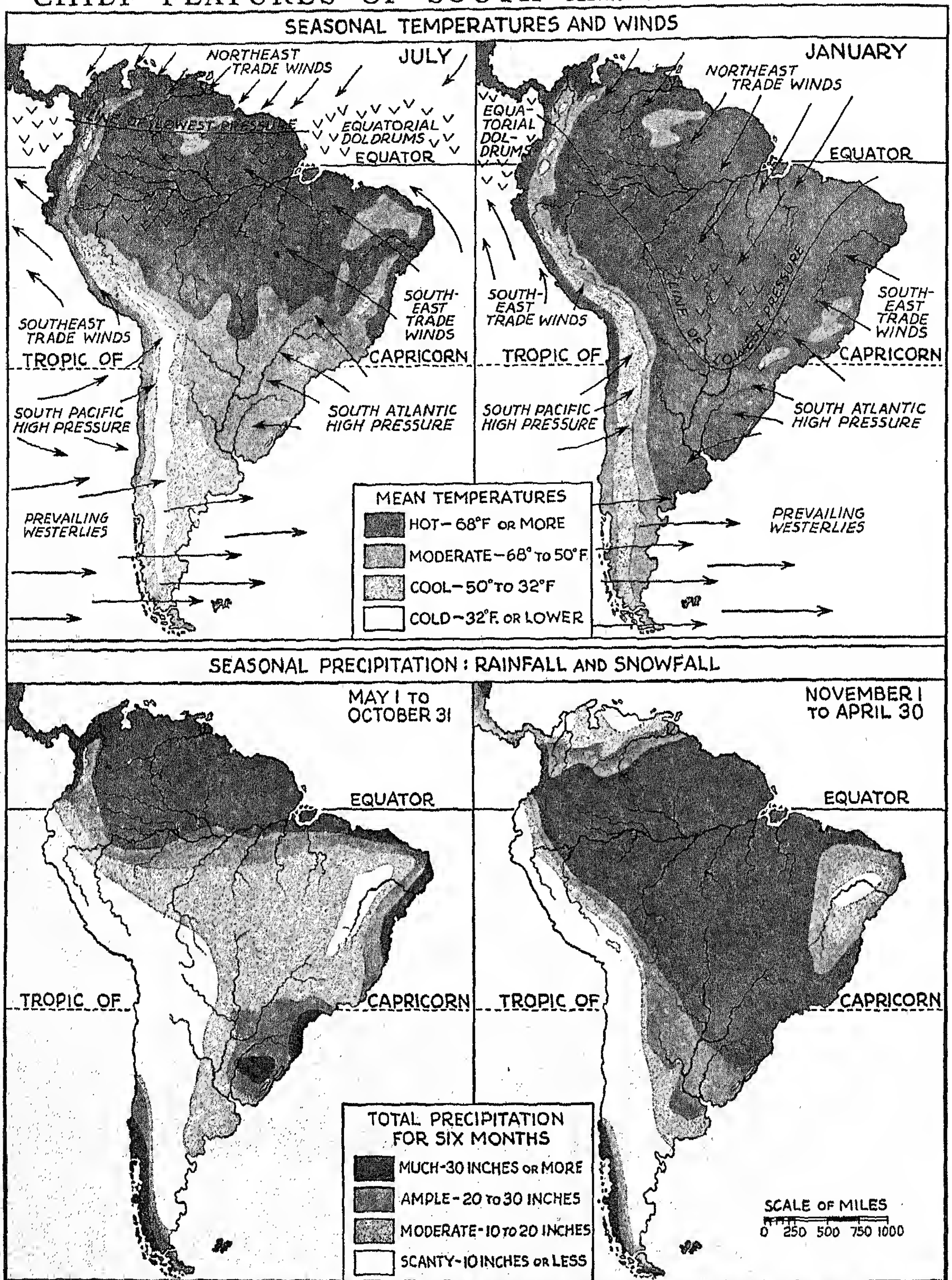
Wet and Dry Seasons

In the tropics the entire system of winds and rainfall shifts north and south with the seasons. The maps on the next page show this clearly. In the South

PRIMITIVE PEOPLE IN TIERRA DEL FUEGO

Trees and people have a hard time of it in the chilly winds that constantly roar over Tierra del Fuego. These Ona Indians are among the world's most primitive people. Their scanty clothing consists chiefly of guanaco furs, and for shelter they build only windbreaks of guanaco hides.

CHIEF FEATURES OF SOUTH AMERICAN CLIMATE



The upper maps show how climate is determined, first of all, by seasonal changes in the overhead position of the sun. When the sun is in the north in July, the greatest heat and lowest atmospheric pressure occur near the north coast (upper left). In January, these conditions prevail near the Tropic of Capricorn (upper right). The prevailing winds shift with the sun, and rainfall follows them (lower maps). Notice, however, that in the west no great changes occur. There the tempering influence of the Pacific Ocean and the towering Andes Mountains keep the climate much the same all year, with only slight north-south shifts.

American summer months from December to March, the belt of tropical rain reaches into southern Brazil, and as far north as the Guiana Highlands. In winter the southern edge of tropical rain shifts north to the Amazon River, and the northern edge is off the continent and over the Caribbean Sea.

The trade winds shift similarly in summer and winter. Hence the difference between wet and dry seasons in the trade-wind belts depends upon whether they are getting trade-wind rainfall or tropical thundershowers. Precipitation conditions in the middle latitudes also shift somewhat with the seasons.

Ocean currents also influence the climate of certain regions. The most important of these is the Humboldt Current from the Antarctic, which cools the west coast from about 40° south latitude almost to the Equator. The on-shore winds that pass over this current are cooled, and thus become drying winds as they blow over the warm land. This helps to make most of this region almost rainless.

How Climate Influences Human Life

The character of the climate has profoundly influenced human life in the various regions. It is the republics of the middle latitudes—Argentina, Chile, Uruguay—and parts of Brazil where height moderates the tropical heat, that are the most progressive, the most productive, and the wealthiest. It is these republics too that have the largest proportion of whites and have attracted the greatest number of immigrants from European countries in the last half century. In the vast tropical lowland areas, white men find it hard to live and work; and here many of the people are Indian tribes living much as their ancestors did centuries ago.

Most of the people live near the sea, at elevations above 1,000 feet, as is shown by the maps on page 208*d*. In the tropical regions of the northwest and the Caribbean countries they live in the cooler interior highlands. Only on the temperate Pampa of Argentina is there any considerable concentration of population at low altitudes.

The great cities too are on or near the coast. Many of these are in pairs: a large city in the higher interior where the temperature is agreeable, with its seaport below on the hot seacoast. Examples are Carácas and La Guaira in Venezuela; Callao and Lima in Peru; Valparaiso and Santiago in Chile; Santos and São Paulo in Brazil.

The Pattern of Human Life and Activities

THE INDIANS of South America, it is generally believed, came from North America at some time after the end of the last Ice Age. But they differ in their languages and in many other ways from those that remained north of the Rio Grande. This indicates that the two groups have been separated for a long time. On the basis of culture, or ways of living, the South American Indians can be divided into the tropical forest Indians, the hunting Indians of the plains and the cool forests, the primitive fisherfolk of the far south, and the advanced mountain or highland Indians of the Andes.

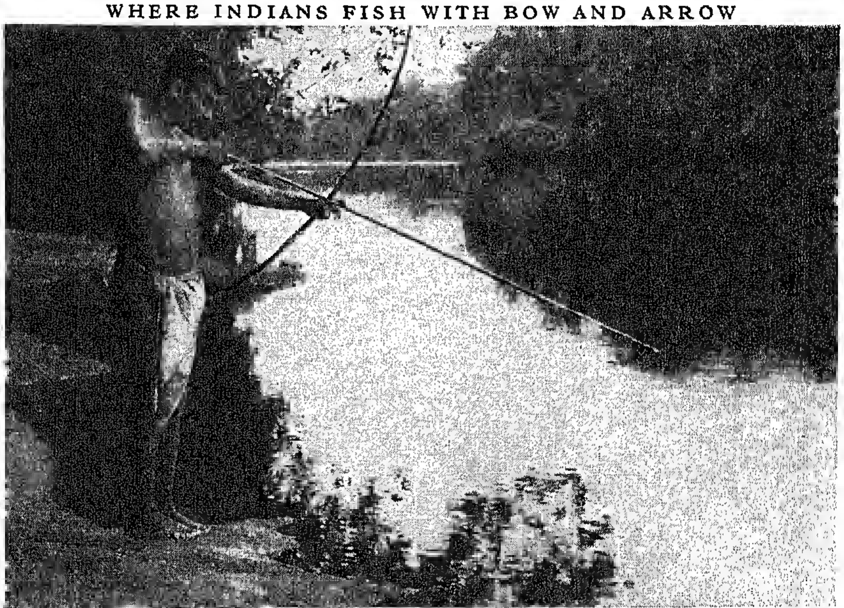
Indians of the Tropical Forest

In the forests of the Amazon, the Orinoco, and the northern coast, the Indians build houses along the rivers on the highest land they can find, to be above flood water in the rainy season. They set poles in the ground to support a floor, with two tall poles to hold a ridgepole for the roof. From the ridgepole they hang thatch made of long jungle grass or shredded palm leaves.

The family sleeps in hammocks made of palm-bark fiber. Hunting weapons hang from the roof. On the floor are pots and other utensils for preparing food, and simple implements for weaving cloth. For cutting tools, in the days before white men brought iron axes and knives, the Indians used stone axes which they got by trade with other regions. They made knives of ironwood, and for drilling and scraping implements they set the teeth of animals in wooden handles.

Men and women usually wear only a piece of fiber cloth wrapped about the waist, and perhaps a band around the hair. Children wear nothing. In this hot

WHERE INDIANS FISH WITH BOW AND ARROW



Natives of the Amazon region shoot fish instead of catching them with hook and line. Some also use long blowpipes from which they shoot poison darts. Their only garment is a bit of fiber cloth tied about the waist.

climate, clothing is more important to hold ornaments and magic charms than it is as covering.

For food, the men harpoon or shoot fish, snare turtles, and hunt other game. From turtle eggs they extract a cooking oil. They place the eggs in a hollow log and tread them into a jelly with their feet; then water is added, and the oil which floats to the surface is skimmed off. Some tribes use the bow and arrow for hunting. Others use a blowpipe, from 10 to 12 feet long. With this they shoot long, thin darts like hatpins, poisoned with curare or with juice from the assaca.

Many tribes practise a primitive agriculture. The men prepare a little clearing by girdling and burning the trees. Then the women grow yams, corn, and cassava (manioc). The roots of the bitter cassava contain a poison. To remove it, the women cut up the roots and place the pieces in a tubelike basket. Stretching and twisting the basket presses out most of the poisonous juice. Washing and roasting destroys the rest. The product is a mealy flour, which is baked into bread and used in preparing other dishes (*see* Tapioca).

INDIANS OF THE PERUVIAN HIGHLANDS

It's All-Saints' Day, and this Indian family is off to the festival in the town. The man in the center is holding a home-made harp, which he will strum as the others dance.

Instead of scalping enemies, as many North American Indians did, some forest tribes in South America cut off the heads and preserved them by drying. The Jivaros, on the lower slopes of the Andes in Ecuador, developed marvelous skill in this. They removed the bone, and then filled the skin with hot pebbles, pressing it carefully to keep the shape while it dried and shrank to the size of a man's fist.

In spite of the easy life and abundant food, the number of forest Indians is small. Some authorities think that the entire Amazon basin contains no more than 100,000 of them. At the time when the white men came the most widespread group was the Tupi. A branch of these folk, the Guarani, was spreading to the south. Mixed with Spanish blood, the Guaranis now make up nearly all the population of Paraguay. The Arawaks and Caribs were powerful on the north coast. The Caribs, now virtually extinct, also peopled the islands of the Caribbean Sea, which got its name from them. (*See also* Amazon River; Brazil.)

Hunting Indians of the South

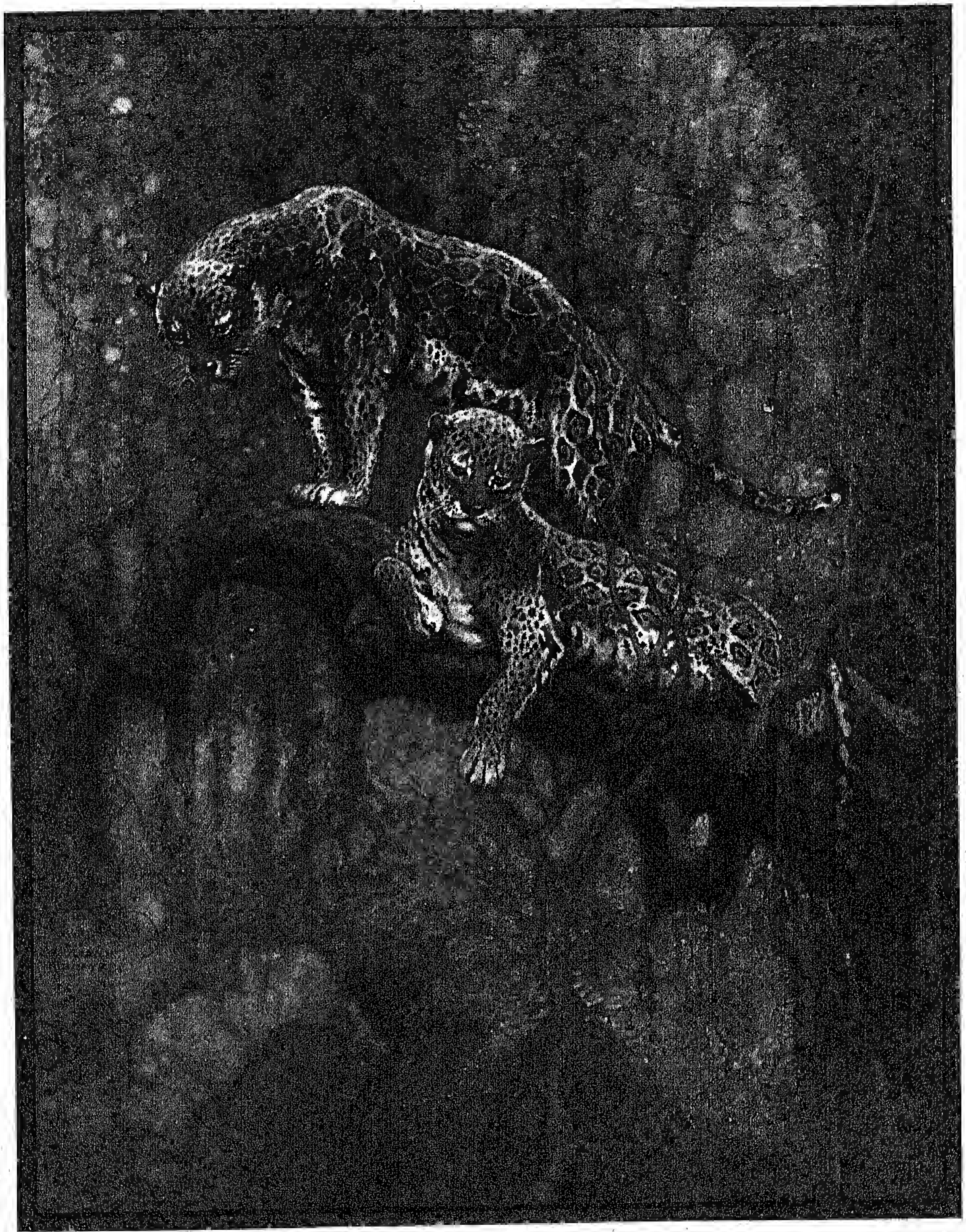
On the grassy Pampa of Argentina, the Indians lived by hunting, much as did the tribes on the western plains of North America. Since they had to follow their game, they built nothing more than windbreaks of hides or brush for shelter. For food they hunted the guanaco (wild llama) with bow and arrow, and the rhea with a *bola*, made of two or more thongs of rawhide knotted together at one end and weighted at the free ends with stones. The hunter threw this missile around the neck or legs of the bird to bring it down, and then dispatched it with a spear.

Only a few remnants of these Pampa Indians still live in outlying districts. They seem to have been a mixture of the Guaranis from the forests farther north, and the hunting Araucanians from the cool forests of what is now southern Chile. The Araucanians call themselves *Mapuches*, or "men of war." They managed to keep the Spaniards out of their territory, and little is known of their early life, except that they lived by hunting and fishing. Today they also raise animals and grow crops. They live in thatched huts with earth floors covered with sheepskin. Both men and women wear bright-colored blankets.

The men also wear a *poncho*, a large, blanketlike square of cloth with a hole in the center for the head. The women go barefooted, bare-armed, and bareheaded, with their hair in two braids held by a band of colored cloth or silver rings. The Araucanians once numbered about half a million, but alcohol and disease have reduced them to a tenth of this. (*See also* Chile.)

Primitive Fisherfolk of Tierra del Fuego

When white men first explored the Strait of Magellan and near-by islands, they found Yahgan and Ona Indians. These people lived in the most primitive fashion. They killed guanaco, when they could, with slings and spears; but the common foods were fish, shellfish, berries, and fungi. For shelter in this



Painting by Herman Rountree

MONARCHS OF THE SOUTH AMERICAN FORESTS

For size and ferocity jaguars rank in the cat family next to tigers and lions. Not only do they stalk their prey on the ground but they also pounce on their victims from overhanging branches of trees. Their mottled coats mimic the play of sunlight and leaf shadows in the forest and render them almost indistinguishable at a short distance.

GIANT FALLS IN A GIANT FOREST

Four and a half times higher than Niagara are these Kaieteur Falls in western British Guiana. Here, in the heart of the tropical forest, the small Potaro River plunges with a mighty roar 740 feet down from the ancient Guiana highlands that stretch back into Venezuela. Even the passing natives pause to look up with awe at the mighty spectacle.

cold region they had mere windbreaks of leaves and bark, covered in winter with guanaco hides. Their only garment was a sealskin or the fur of a guanaco, worn on the shoulder toward the wind. They fished in bark canoes, which always carried a fire built on sod in the middle. They made knives and hammers of stone, and used a whalebone tool to pry bark from trees. These Fuegian tribes have all but disappeared.

On the mainland north of the Strait of Magellan, the Patagonians lived almost as rudely; but, in spite of their hard life, they were among the tallest of men. Their name, given by Magellan, means "big feet." Few of them survive.

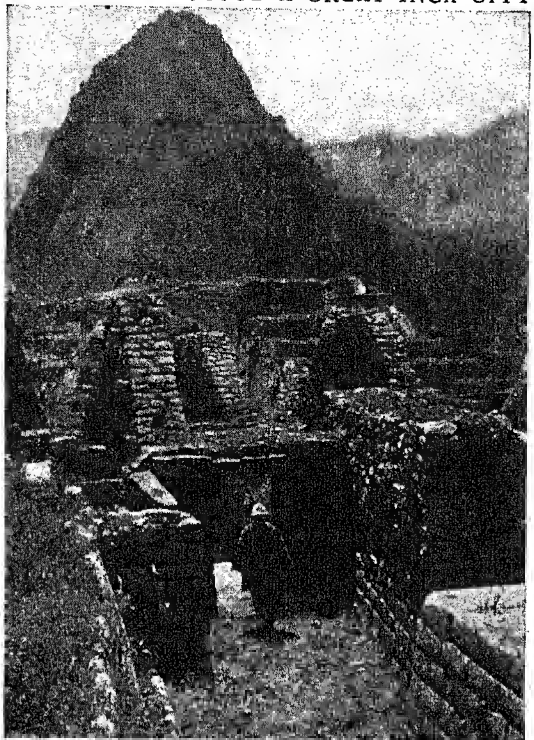
Highland Indians

In contrast to these primitive folk stood the advanced Indians whom the white men found living over most of the Andean highlands. Chief of these were the Incas of Peru. In many ways these people were as highly civilized as the Egyptians and the Sumerians of Mesopotamia at the dawn of history. Although they had invented neither writing nor the wheel, in government and many arts and crafts they were fully equal to the founders of civilization in the Old World. They made tools and rich ornaments of copper, bronze, silver, and gold. They spun thread as fine as the best made today, and wove it into rich fabrics. In the highlands they used llama wool; on the lower coastal lands of Peru the favorite material was cotton. They made splendid headdresses of feathers, and they made fine pottery.

The most impressive work of the Incas, however, was in building with stone. They enlarged their fields on the steep hillsides by building stone terraces filled with soil. Stone aqueducts carried water over valleys for irrigation and to supply towns. Stone roads and bridges connected the cities, with post houses and trained runners every few miles to carry government messages.

One of the many remarkable structures which still stand is the Great Wall of Peru, a chain of forts connected by a wall, running inland from near Chimbote in northern Peru. This is illustrated on page 205*d*. Like the Great Wall of China, it was built to hold out invaders; but nobody knows whether a neighboring tribe built it to keep out the conquering Incas or the Incas built it to hold one of their frontiers. Another amazing ruin is a town built of stone at Machu Picchu, near Cuzco in Peru. Here are the remains of a huge temple, a convent for Inca priestesses, palaces, and a tower which may have been a tomb. The town was a maze of narrow streets and stone stairs; fountains abounded. Today we can only guess how these Indians achieved such high development, since they left no written records to tell us. We know, however, that the absence of trees made cultivation easy, and mountain snow made irrigation possible. They had plenty of easily worked copper and tin. From this they could make bronze tools for working the abundant stone.

WHERE ONCE STOOD A GREAT INCA CITY



The vast ancient city of Machu Picchu was forgotten for centuries until its ruins were discovered in 1911.

The Incas, who spoke the Quichua (or Quechua) language, held under their rule a more numerous people, the Aymarás. Their domain extended north into Ecuador. In Colombia lived the Chibchas. These people did not build with stone, and the relics they left do not show so highly developed a civilization as that of the Incas. But they were important because they served as a connecting link between the Incas and the great Maya civilization of Central America. (*See also* Incas.)

Most of the Indians of Peru and Bolivia still live in much the same way as their Inca ancestors did. They still rely for food upon the tiny grain *quinoa*, and on barley and potatoes. The potatoes are kept as *chuño*. This is made by freezing the potatoes, then thawing them and squeezing out the water. They become dark, shriveled, and corklike, and will not spoil. Natives living near lakes obtain some fish and game birds. In the lower valleys they grow beans and corn.

Where rainfall is scanty, they irrigate their fields with water supplied by melting snow on the mountains. One of their peculiar implements is a foot-plow, worked by a team of two men and a woman. The foot-plow is a stout stick with a broad, pointed end and two projections. A man grasps one projection with his hand, and steps on the other to drive the stick into the earth. Another man does the same alongside, and the two pry up a clod of earth. A woman then pounds the clod into loose soil.

Houses are made of adobe or stone, with a thatched roof of grass or reeds. Doors are made of split cacti or hides. For fuel the natives use dried llama dung and the *tola* and *yareta* plants.

Clothing is made of wool, either from the llama or from the sheep. In the bitter winter weather and on great heights everyone wears a woolen cap with ear tabs. Over this the men wear a felt hat with a narrow brim. Women's hats have broad brims. The outer garment is a poncho, dyed red, green, or yellow. Women wear many skirts. The men wear trousers, slit down the back below the knee. The slit is lined with brightly colored cloth.

White Life and Activity

The life of the early white settlers, with its basis of Indian and Negro labor, set the pattern which still continues over much of the continent. The white people practise agriculture where conditions are favorable, and they undertake such manufactures as local resources make possible. In Argentina, and to some extent in Uruguay and southeastern Brazil, the whites participate in every kind of work. But Indians, Negroes, and mestizos perform most of the manual labor, while the whites occupy themselves with management and business, politics, intellectual pursuits, and sports. Wealthy landowners are likely to spend little time on their estates, preferring to congregate in the cities and travel abroad.

Scarcity of Busy Cities

The absence of industry, in comparison with North America, is shown by the small number of cities. South America has only two cities—Buenos Aires and Rio de Janeiro—with more than 1,000,000 population; North America has six. South America has about 35 cities with populations between 50,000 and 1,000,000; North America has more than 200 such cities.

RIDER OF WEST ARGENTINA

Many of the gauchos or cowboys of Argentina are of white stock. Notice the woolen poncho this one is wearing.

Of all the South American cities, only Buenos Aires, Rio de Janeiro, São Paulo, Montevideo, and Valparaiso have much manufacturing, though some of the smaller cities have small manufactures of articles for local consumption. Industrial development has been restricted by the lack of conveniently situated supplies of iron and by the poor quality of the coal. And though the continent has 12 per cent of the world's potential waterpower, only a small fraction of this is used. Most of the cities therefore are chiefly important as national and provincial capitals and as trading and shipping centers. In all of them the South American love of art is evident. Churches, public buildings, and plazas are made as beautiful as the city can afford. The large cities have splendid theaters and motion-picture houses. Bands play in the public squares and a gay, open-air life prevails wherever climate permits.

Rural Life on Haciendas and Estancias

Life in the country presents marked contrasts to farm life in the United States. There are few small and medium-sized farms. The typical South American farm or ranch is a *hacienda* or *estancia* of several thousand acres. The center is the owner's spacious and comfortable home. Grouped around it is a cluster of workers' homes, barns, and workshops with perhaps a store. In many parts of South America no other centers of population exist; the haciendas take the place of towns.

In such districts peddlers travel about, selling articles which the haciendas do not provide. Dentists and doctors also travel from district to district, taking their equipment on pack animals. Even lawyers and notaries can be seen picking their way along the trails, with a typewriter strapped to the saddle.

Transportation and Communication

IN A CONTINENT so largely occupied by forests and mountains, with a widely scattered population, the development of transportation has naturally not been the same as in the United States or Canada. Highways and railroads have been built only in regions offering sufficient traffic to warrant the expense. These are being extended constantly, as production increases. But, for a long time, large parts of South America will continue to get along with the forms of transportation which best suit their topography and economic position. In most of the high Andes, goods will continue to be moved along narrow trails by trains of llamas and by human burden-bearers. In the sparsely peopled parts of the plateaus and plains, carts and pack animals will travel slowly over unsurfaced roads. In the basins of the Amazon, the Orinoco, and the Plata, and on other lesser streams, traffic will continue to be carried cheaply and conveniently by water.

Inland and Ocean Waterways

In navigable rivers South America is well served on its Atlantic side. Ocean steamers can travel nearly a thousand miles up the Amazon to Manáos, and large river steamers can go 1,300 miles farther, to Iquitos in Peru. Smaller power boats can reach the foothills of the Andes. The Orinoco is navigable by large steamers for 700 miles or more. Commercially, the most important waterway is the Paraguay-Paraná-Plata system, which serves a vast productive region.

The São Franciseo in Brazil, the Essequibo in British Guiana, and the Magdalena-Cauca system in Colombia are also important routes. Lake Titicaca, high in the Andes, is traversed by steamers that connect the railways of Peru and Bolivia. On the Pacific side, the only important river highway is the Guayas, navigable for 160 miles.

On the oceans, regular and frequent steamship service connects South American ports with Europe, Asia, and North America, as well as with one another. Coastwise shipping carries most of the trade between the South American republics, since road and rail connections between them are few and land transportation is costly. Tourist travel, especially from the United States, has greatly increased in recent years.

The Panama Canal has been an important factor in promoting trade between the west coast of South America and the United States. Before the canal was built, a trip from New York City to Valparaiso was 9,000 miles by Cape Horn; by way of the canal it is only 5,100 miles. (*See* Panama Canal.)

Costliest Railroads in the World

The story of railroad building in South America is an epic of skill, daring, and endurance. The massive Andes, with their steep slopes and great heights, make railroads exceedingly difficult to build and costly to operate. All the equipment and nearly all the fuel have to be imported. Tunnels have to be driven through the mountains, shelves blasted out of their sides to support the roadbed, and bridges built across the chasms. In many places the grades are so steep that locomotives cannot get enough grip on the rails to haul up the cars, and engineers have to use cogways and cableways.

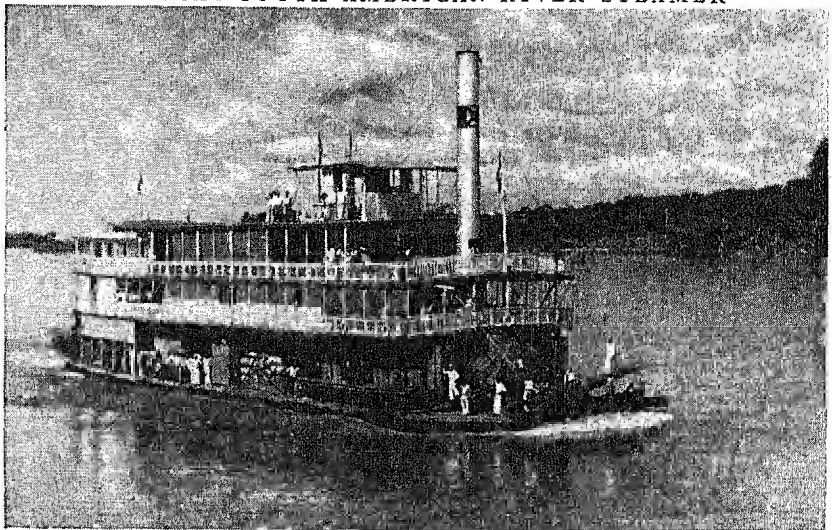
Yet two transcontinental lines exist. The Transandine railway connects Valparaiso, Chile, with Buenos Aires, Argentina. The other line is from Buenos Aires through northern Argentina into Bolivia. From La Paz, Bolivia, there are three routes to the Pacific. One goes to Antofagasta, Chile; another to Arica, Chile; and a third, after crossing Lake Titicaca by steamer, goes to Mollendo, Peru.

The journey of 886 miles between Buenos Aires and Valparaiso takes about a day and a half, largely because of the time taken to crawl up by winding track and cograil to a tunnel 10,452 feet above sea level. The train trip from Buenos Aires to La Paz, a distance of 1,663 miles, takes three days.

The Peruvian Central, extending from Callao on the Pacific coast into the high Andes, is the highest railroad in the world and one of the most remarkable. In its first 106 miles it climbs more than 15,600 feet—nearly three miles. In this stretch alone are 65 tunnels, 67 bridges, and 16 switchbacks. Another stupendous railway connects Guayaquil, Ecuador's seaport, with Quito, its capital in the Andes. Numerous shorter railroads exist in the narrow coastal valleys of the Andean countries, and elsewhere where economic development warrants their construction. In Chile a longitudinal line extends through the beautiful Central Valley.

In eastern South America railroad nets exist where topography and climate have permitted the development of large farming and live-stock industries. On the wide flat plains, railways radiate in all directions from Buenos Aires and Rosario. Similar networks exist on the lowlands of Uruguay, with Montevideo as center; and on the southeastern part of the Brazilian plateau, especially around Rio de Janeiro and Santos-São Paulo. Short lines occur elsewhere where traffic is sufficient to maintain a railway. Most of these are mere stubs that run inland from the seacoast to some special source of traffic and then stop. The total railway mileage for the entire continent is little more than 60,000 miles. Five-sixths of this is in Argentina, Brazil, and Chile. A serious difficulty is the great variety of gauges, which makes it necessary to reload shipments frequently.

TYPICAL SOUTH AMERICAN RIVER STEAMER



This boat is carrying freight and passengers up the Magdalena River in Colombia. Similar craft ply the waters of the Orinoco, Amazon, and Paraguay rivers. With their flat bottom, stern paddle wheels, and high stacks, they resemble the old Mississippi steamboats.

Far-Flung Airplane Service

In striking contrast to the limited railroad development is the tremendous recent expansion of aviation. No other continent leans so heavily on the airplane for the transportation of passengers, mail, and express freight. The airplane was an incalculable boon to South America. It costs practically nothing for right of way, and flies over mountains and jungles almost as readily as it does level ground. Today every important city has airplane service, as does every inland district where any considerable number of white people live. The airplane has aided materially in developing formerly inaccessible areas, especially some rich in mineral resources.

The first commercial air service in the Western World was installed by the SCADTA line in Colombia in 1920. This has reduced travel time between Barranquilla, the chief port, to Bogotá, the capital in the interior highland, from 9 days to less than 3 hours. International services connect all the republics with the United States, the Orient, and Europe. By Pan American clipper, Buenos Aires can be reached in four days from the United States, whereas the ocean journey takes nearly three weeks.

Progress in Building Motor Roads

Just as South America has turned to the most modern means of transportation, the airplane, to solve part of its transportation problem, so it is also turning to another modern means, the automobile and the truck. The airplane serves to connect the great primary centers and to transport passengers and a limited amount of goods. Where railways are impracticable because of their cost, motor roads are being built to connect both the primary and the secondary centers and to carry bulky freight. Nearly every country is spending more and more of its national income in building roads.

Uruguay and Argentina have made the greatest progress, because road building is easier on their flat plains and because their farms and ranches supply enough traffic to warrant the expense. Brazil too has been extending its system of roads in the populous southeast, and Peru has built a spectacular highway over the Andes from Lima to Pucallpa, on a tributary of the Amazon.

In most regions road building, like railway building, is difficult and expensive. In the Andean countries, the mountains and the great distances between centers of population make the construction of motor roads almost prohibitive. In the wet tropical regions, swamps, heavy rainfall, and the lack of materials are similar obstacles. Hence it is not surprising that the entire continent has only about 300,000 miles of road—one-sixth as much as the United States—and that much of this mileage is unpaved and impassable to motor vehicles except in favorable weather.

The Pan American Highway

The most ambitious road-building project is the continent's share of the Pan American Highway, intended to run from Alaska to the Strait of Magellan. This project has been discussed in several Inter-American conferences since 1923, and a Pan American Highway Confederation with headquarters in Washington, D. C., was organized in 1924. In the south and east, Rio de Janeiro is now connected by fair roads with Buenos Aires, with a ferry link across the Rio de la Plata. A partly paved road connects Buenos Aires with Santiago, Chile. This uses the Transandine railroad tunnel but the mountain portions are blocked with snow in the winter months. On the Pacific side, a reasonably good road extends from Santiago to the border of Ecuador, with only two short gaps in Peru. In the north, Quito in Ecuador is connected through Bogotá, Colombia, with Carácas in Venezuela by the Simón Bolívar International Highway, which is also called the *Carretera de los Andes.*

Ecuador still has a 100-mile gap in the road to the Peruvian border. The most serious gap, however, is the 300-mile stretch from Panama to a connection with the Bolívar Highway. Most of the route is through an unexplored, forested swamp. A ferry service from Cristobal in Panama to a Caribbean connection with the Bolívar Highway may be used, instead of trying to build a road on such land.

Improvements in Communication

Until recent years communication by mail and newspapers has been limited by lack of transportation in the less settled regions. Even telegraph service was difficult to provide in many places, because the lines could not earn enough to pay for their cost. The various governments established lines and services for official needs; but these lines left many communities hundreds of miles away from any modern means of communication. Telephones were limited to the cities, and many cities were not interconnected.

Today, the airplane transports mail and newspapers quickly between all important centers, with immense benefit to business, public affairs, and general enlightenment. Radio has been equally helpful, both in broadcasting news, and in providing telephone service between places not connected by wire. Every town in the Amazon valley, for example, now has radio telephone connections. Wire telephone and telegraph services have also been greatly extended.

South America has had cable connections with other continents for many years, but the radio has made telephone connections possible as well. Radio also has brought in many points which were not served directly by cable. Every nation now has its broadcasting services which can reach Europe and America. United States correspondents report important events in broadcasts that reach all parts of North America. Foreign nations, in turn, direct a continuous flow of short-wave programs to South America, to win the sympathies of its people. Broadcasts from the United States seek to strengthen inter-American unity.

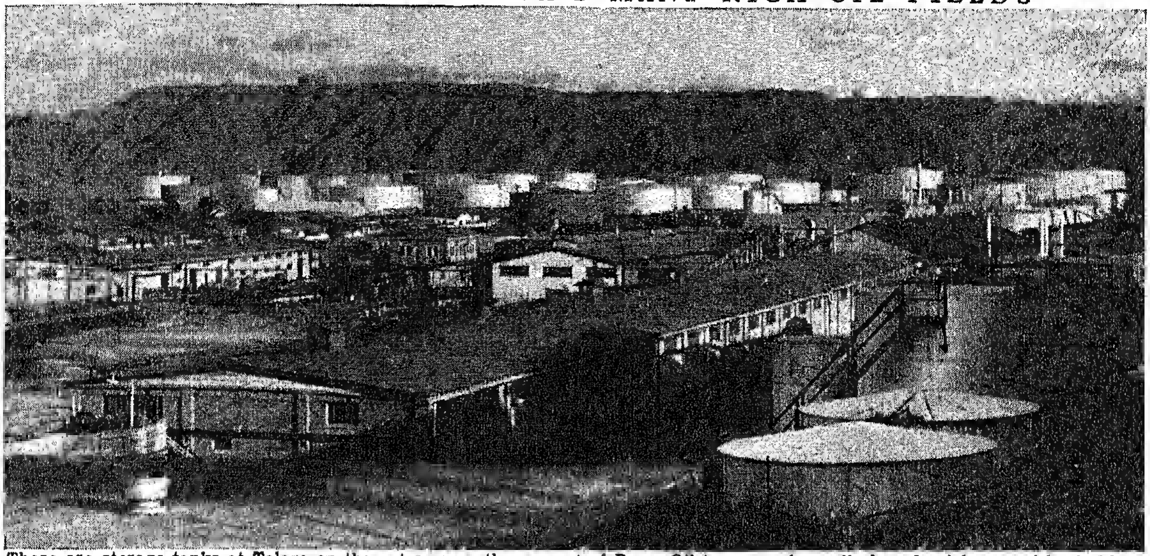
Production and Foreign Trade

SOUTH AMERICA's rôle in world economy is that of a vast reservoir of food, minerals, and other raw materials. It already supplies about 7 per cent of the world's exports, and this proportion can be greatly increased as its resources are further developed. Of world imports, it takes only about 5 per cent. The difference enables it to pay interest and dividends on the billions of foreign capital invested in its business enterprises and government loans.

Agriculture, Crops, and Live Stock

Agriculture is by far its greatest source of wealth. Yet only between 4 and 5 per cent of its area is under cultivation, and 90 per cent of this cultivated area is in two countries—Brazil and Argentina. From this small fraction of the continent come the exports which are its lifeblood; for three-fourths of the

ONE OF SOUTH AMERICA'S MANY RICH OIL FIELDS



These are storage tanks at Talara on the extreme northern coast of Peru. Oil from nearby wells is refined here and loaded into tankers in the harbor. Petroleum accounts for about half of Peru's mineral production. It was discovered by the early Spaniards, who used it only to waterproof the material with which they caulked their ships.

exports are the products of farm and range. More than half of the cultivated land is devoted to raising corn, coffee, wheat, and the alfalfa which pastures the great herds of live stock. A small fraction grows flaxseed, cacao, cotton, and sugar, which are also important exports. The rest of it grows crops chiefly for home consumption. Among these are tobacco, olives, peanuts, tropical fruits and vegetables, citrus fruits, grapes, and a wide variety of cereals. Cattle and hogs are raised in all countries. Sheep raising is important in Argentina and Uruguay.

In the recent years before 1939 when the outbreak of war in Europe upset South American trade with the world, this continent supplied about 65 per cent of the world's coffee; from 15 to 30 per cent of its exported wheat and flour; 75 per cent of its exported corn; 85 per cent of its flaxseed; 25 per cent of its cacao beans; 80 per cent of its chilled and frozen beef; 20 per cent of its mutton and lamb; 90 per cent of its canned meats; 30 per cent of its hides and skins; and 10 per cent of its wool.

Mineral Production

Every country has mineral resources, but mining is of chief importance in the Andean countries. All the world's natural sodium nitrate comes from Chile, but markets for this valuable fertilizer have been much reduced by the manufacture of synthetic nitrogen compounds in the chief consuming countries. Bolivia supplies 25 per cent of the world's tin. Chile, with Peru and Bolivia, supplies 25 per cent of its copper. Peru is the leading producer of bismuth and of vanadium, an indispensable alloy metal for the steel industry. Colombia yields most of the world's emeralds and a large part of its platinum. Brazil is a chief source of industrial diamonds and has the world's largest manganese deposits. All the Andean countries yield some gold and silver. The Guianas supply gold, diamonds, and bauxite (aluminum ore).

In petroleum production, South America is one of the major world sources. Venezuela, Colombia, and Peru are the chief producers, but there are deposits also in Bolivia, Argentina, and Ecuador. In the other mineral resources basic to modern industry—coal and iron—South America is limited. Coal deposits occur in Brazil, Chile, Argentina, Bolivia, Colombia, and Peru; but they are thin and poor, and mostly remote from transportation. Since most South American coal is not suitable for use in making iron and steel or is too remote, the development of the iron deposits has scarcely begun. Chile produces high-grade iron ore, most of which is shipped to the United States. Brazil too has enormous deposits of high-grade iron, but little is mined.

Forest Products

Nearly half of South America is covered with forests—a far greater proportion than in any other continent. The products of these forests are varied and important, but they form only about 10 per cent of the total trade. Quebracho, a tanning material obtained from the heartwood of the quebracho tree of Argentina and Paraguay, ranks highest in value of forest products exported. It is marketed either in the form of logs or bricks of the dried extract. Rubber, balata (an elastic gum like gutta-percha), Brazil nuts, vegetable wax, ivory nuts, and cabinet woods are other leading items of export, chiefly from Brazil. *Yerba maté* is exported from Brazil and Paraguay, chiefly to other South American countries.

Trade Handicaps; Manufactures

A fact which places South America at a disadvantage in world trade is that most of its countries depend largely on the export of one or two products or

groups of products. Argentina depends on grains and animal products; Brazil on coffee and cotton; Chile on copper and nitrates; Bolivia on tin; Colombia on coffee and petroleum; Ecuador on cacao, coffee, and petroleum; Paraguay on cotton and quebracho; Peru on petroleum, cotton, and copper; Uruguay on animal products; Venezuela on petroleum.

Until recent years the nations of South America did little manufacturing. Lack of skilled labor, of iron and coal, and of capital worked to prevent any considerable growth of industry. But disturbances in foreign trade and difficulties of exchange caused several countries to build up manufactures at home and thus make themselves more nearly self-sufficient. In this development the "A B C countries"—Argentina, Brazil, and Chile—have led. Peru also has a considerable industry. Manufactures are of two types: the processing of raw materials for export and the manufacture of consumption goods for domestic use. The first includes meat packing and refrigeration, flour milling, ore concentration, and similar processes. Products for home consumption include cotton cloth, shoes and other articles of clothing, furniture, cement and other building materials, soap, cigars and cigarettes, prepared meats, tires, paints, matches, paper, glass, and household utensils. Automobile assembling has also become a considerable branch of industry.

MANGANESE DEPOSIT IN BRAZIL

Steel makers need manganese, and Brazil's output has been booming. The deposit shown here is one of many in the province of Minas Geraes.

There is however virtually no heavy industry. So all the South American countries have to import locomotives, railroad cars, motor vehicles, and all kinds of agricultural and industrial machinery. Radios, sewing machines, refrigerators, and other kinds of household equipment are for the most part imported, though such manufactures are increasing. Despite the growth of manufactures, about half of all the imports consist of shoes and other clothing, foods, beverages, and tobacco. Such imported goods are, of course, luxuries which can be bought only by the well-to-do classes of the cities.

Trade with the United States

The United States is by far South America's best customer. It is also the continent's chief source of supply. It normally takes between one-fourth and one-fifth of the exports, and supplies on the average more than one-fourth of the imports. Great Britain, which occupied first place in South American trade until the World War of 1914–1918, has dropped to second place. Before the outbreak of another European war in 1939, Germany was a close third, though it sold South America far more goods than it was able to buy. France, Italy, and Japan account for most of the remainder of the continent's foreign trade. Only about one-tenth of all the trade is between nations within the continent.

United States trade with South America consists essentially of the exchange of tropical foodstuffs and raw materials for manufactured and semimanufactured products. The United States takes about a third of Brazil's coffee, cacao, and nuts; about a fifth of the minerals and tropical products of the west coast countries (Chile, Peru, Bolivia, and Ecuador); most of Colombia's coffee; but only about 15 per cent of Venezuela's petroleum and 10 per cent of the agricultural and animal products of Argentina, Uruguay, and Paraguay. The products of the last four countries are largely competitive with those of the United States and hence find their chief markets in Europe.

In return for these commodities, United States manufacturers sell the South Americans automobiles, trucks, mining and electrical machinery, agricultural equipment, cotton cloths, wheat flour, and an endless list of smaller items.

This trade forms a considerable part of the total foreign trade of the United States, making up about 12 per cent of its total imports and about 10 per cent of its total exports. This amounts to nearly 60 per cent of the entire trade of the United States with the twenty Latin American republics.

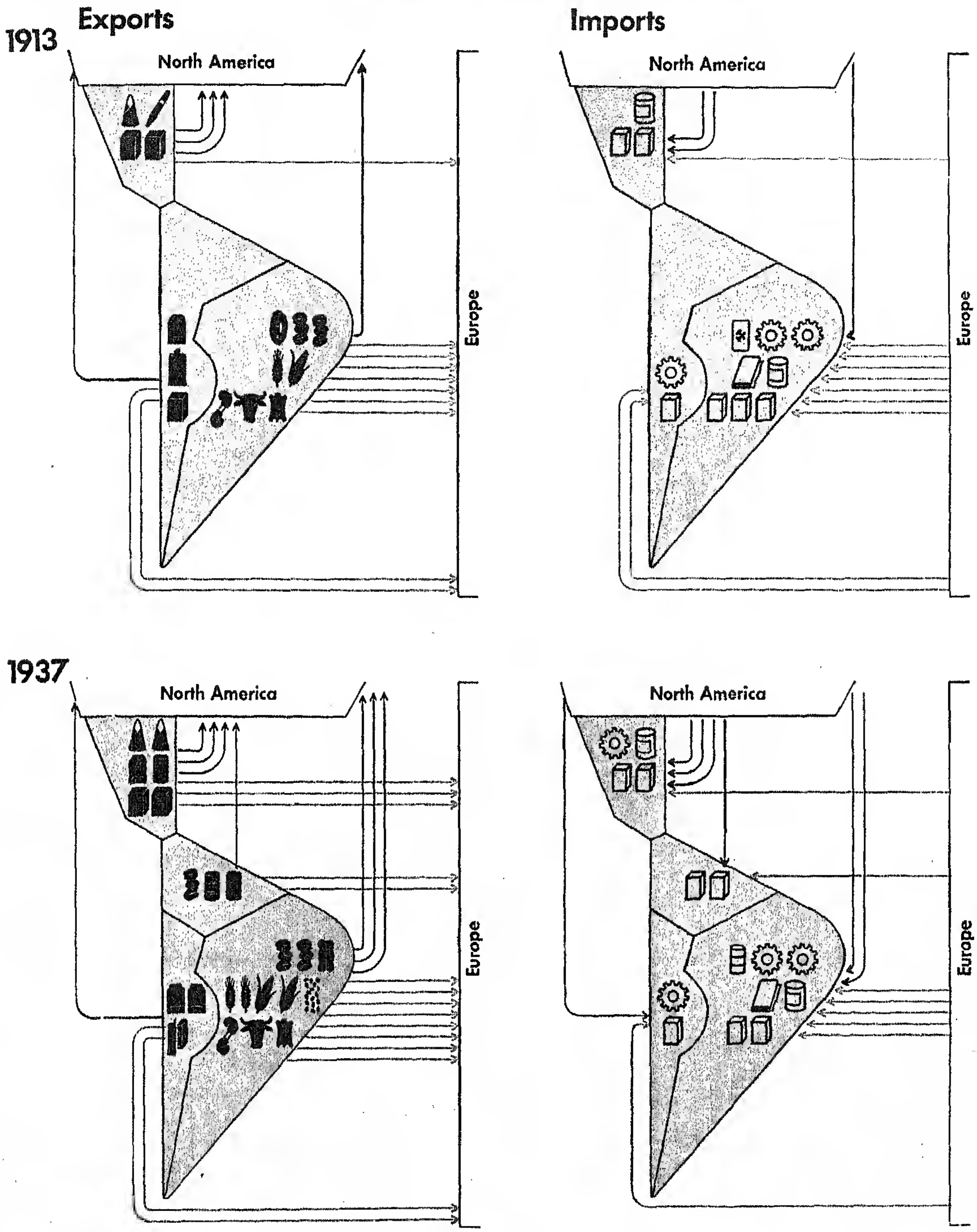
The Big Four in South American Trade

Four South American countries do between 80 and 90 per cent of the continent's foreign trade. Argentina ranks first, supplying about 40 per cent of the exports, in value, and taking about the same share of the imports. Brazil supplies about 20 per cent of the exports and takes about 25 per cent of the imports. Venezuela's vast oil production has recently put it about on a level with Brazil in exports, but it takes only about 6 per cent of the imports, since much of the profits of the petroleum industry goes to foreign capital. Chile supplies about 10 per cent of the exports and takes about 9 per cent of the imports.

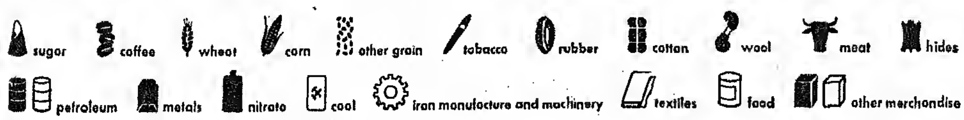
Recent Trade Developments

When the outbreak of war in Europe in 1939 upset the normal course of South American trade by cutting off many of its markets, the United States took far-

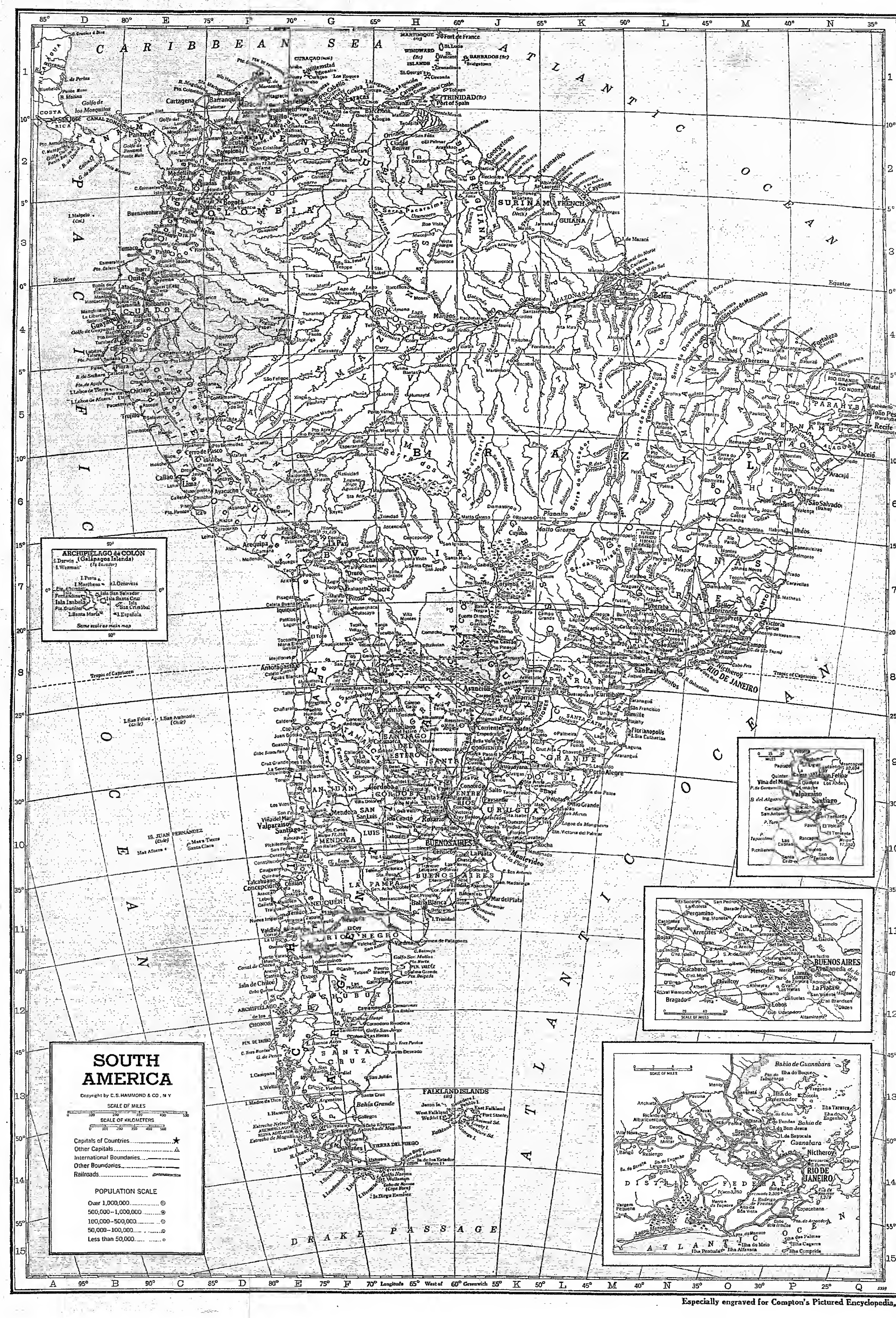
Trade of Latin America with North America and Europe



Each line represents 100 million dollars (Trade with the rest of the world: less than 100 million dollars)

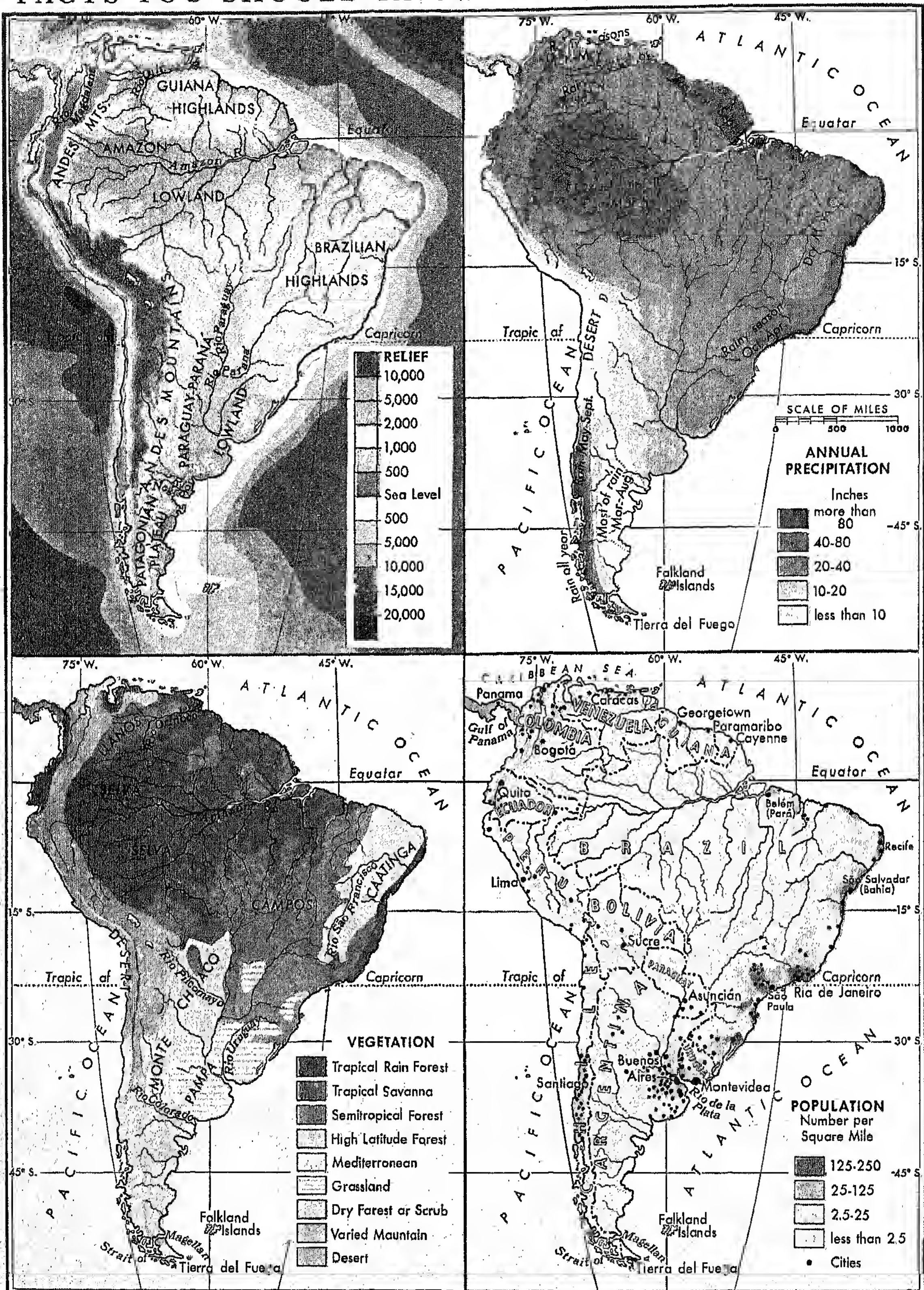


Prepared for Compton's Pictured Encyclopedia



Especially engraved for Compton's Pictured Encyclopedia.

FACTS YOU SHOULD KNOW ABOUT SOUTH AMERICA



These maps show how all the outstanding features of South America follow much the same pattern, with the high ridge of the Andes serving as a backbone. Notice how most of the population is concentrated around the rim of the continent.

reaching steps to help its neighbors solve their economic problems. Diplomatic and commercial officials of the various countries conferred frequently to find ways in which South American surpluses might be marketed in an orderly fashion. The greatest fear was that a victorious Germany would be in a position to bring South American countries under its economic and perhaps political control. No single country, faced with the necessity of selling its products in an unprotected market, would be able to hold out against any terms Germany might offer, however much it might dislike totalitarian barter deals and exchange controls.

The United States was vitally interested in helping South America maintain its economic independence as an essential element in hemisphere defense. Among the steps that it proposed were commodity agreements fair to both producers and consumers, consideration of methods for improving the standard of living of the peoples of the Americas, and Export-Import Bank loans to South American nations. As a defense measure, attention was also directed to the possible increase of production of essential and strategic raw materials, such as tin, manganese, tungsten, antimony, and rubber. Trade with the United States increased sharply in 1940, but nevertheless huge surpluses of the materials which that country could not use continued to pile up in South American warehouses. (*See also* International Trade; Latin America.)

COTTON BALES FOR DISTANT MARKETS

Brazil, Peru, and Argentina lead in the production of cotton. Here we see bales being transferred from a lighter to a ship at anchor. On the west coast of South America protected harbors are rare, and ships are loaded and unloaded in open roadsteads.

Natural Regions: Their Climates and Resources

In trying to understand South America, one must constantly keep in mind that it is not one country, but thirteen. These thirteen countries differ from one another almost as sharply as do the various countries of Europe. Underlying all other differences are the differences of physical makeup, climate, and natural resources.

South America falls into seven main natural divisions. Four of these are the highland masses which make up the rim of the continent: the Andes on the west and north; and on the east the Guiana Highlands, the Brazilian Highlands, and the Patagonian Plateau. These highlands enclose the vast interior lowlands which make up nearly three-fourths of the entire area: the Orinoco basin, the Amazon basin, and the Paraguay-Paraná plains. (*See* map on opposite page.)

1. THE WESTERN MOUNTAIN BELT

The Andes are the backbone of the continent. They stretch from the Caribbean coast to Cape Horn like a huge sickle, with the curve in the north and the straight handle in the south. The slopes toward the Pacific are extremely abrupt. Except in a few places the coastal plain is only a narrow strip. The eastern slopes are gentler and wider.

Volcanic eruptions and earthquakes are frequent, and sometimes destroy whole cities. In many places houses are only one story high because low houses are less likely to fall, and are less dangerous to their inhabitants if they do. (*See also* Andes Mountains.)

Northern Andes and Their Coastal Plains

In the north, the Andes rise from the Caribbean in three main ranges, rising to heights of more than 18,000 feet in Ecuador. Between the ranges in northern Colombia are the valleys of the Cauca and the Magdalena rivers. The Eastern (Oriental) range divides into a wide V which encloses the Maracaibo basin. The eastern side of the V is continued along the Caribbean coast in a double range. Gold, silver, copper, and iron exist in the mountains. Petroleum deposits in the Lake Maracaibo region, in Trinidad, and in the Magdalena valley are worked intensively.

The Caribbean coast has a rainy season from April to November. The rest of the year the climate is dry and hot. Maracaibo is the hottest place in the continent, with a mean temperature of more than 83° F. Much of the land is a savanna of mixed grass and trees, but coconut palms, cacao, bananas, mangoes, oranges, and lemons are grown in favorable spots. A short journey up the mountains brings the traveler to a semitropical climate at about 1,300 feet. Here coffee and sugar cane flourish, up to about 5,000 feet. Above this, rice and other cereal grains are grown, as well as tobacco, cotton, and fruits.

The narrow Pacific coastal strip of Colombia lies in the equatorial doldrums belt. Warm rain falls every day. Tropical forests cover the land, and the region

is unhealthful. Negroes and mulattoes make up much of the population. A little gold and platinum are mined; other products are coffee, cacao, and vegetable ivory.

Farther south, in Ecuador, the Pacific coastal plain reaches its greatest width, 80 to 100 miles. Much of it is covered with tropical rain forest, which yields vegetable ivory and the toquilla fiber of which Panama hats are made. Coffee, cacao, and cotton are grown on large estates. But the lowlands are unhealthful, and most of the people live in the highlands, where they grow subsistence crops of barley, corn, potatoes, and beans. The climate ranges from tropical heat and abundant rainfall at sea level to intense cold on the high Andes. Here the two famous volcanic peaks, Chimborazo and Cotapaxi, tower to about 20,000 feet. (*See also* Colombia; Ecuador; Venezuela.)

The Central Andes and Their Plateaus

The highest and broadest part of the Andes is the central part, in Peru, Bolivia, and northern Chile and Argentina. To the west, between the Andes and the low Coastal Range, lies a long desert plain. Between the ranges of the central mountain mass are broad plateaus, 11,000 to 15,000 feet high. The ridges and many volcanic peaks tower above 20,000 feet. So great is the altitude that many travelers have to break their journey half-way up for a day or two, to become accustomed to the change. The Indians are remarkable for their large chests, which enable them to breathe greater quantities of the thin air.

Grain, cotton, and fruit are grown by irrigation in the many short river valleys of the almost rainless Coastal Desert of Peru. The plateaus receive moisture enough from melted snow to grow hardy food plants, such as potatoes and barley, and to raise sheep and llamas. The region has great mineral wealth, chiefly in petroleum, copper, tin, and silver.

On the slope from the central highlands down to the Amazon basin is a narrow belt of subtropical and tropical vegetation, called the *montaña* in Peru and the *yungas* in Bolivia. The hot, wet climate favors the growth of rubber, balata, and the coca shrub, source of cocaine. Cassava, sugar cane, coffee, corn, and many other crops are raised. But development is limited because of the difficulty of reaching markets, and the population is sparse and isolated. (*See also* Bolivia; Peru.)

The Southern Andes and Coastal Regions

The southern part of the western mountain belt, which makes up Chile and the western margin of Argentina, has the Andes on the east and the low Coastal Range on the west. All the Chilean coastal ledge north of latitude 30° S. is a hot desert, the Atacama. The utter lack of rain has preserved immense beds of nitrate of soda, which is one of Chile's principal sources of wealth.

The Central Valley, between the Coastal Range and the Andes, is the richest part of Chile for agriculture, and it supports most of the population. It is so narrow that from almost any point on the coast voyagers can see the snow-capped Andes to the east. Nearness to the sea provides an even, Mediterranean climate, without violent seasonal change.

South of the Central Valley, moisture-laden westerly winds drench the seaward slopes of the Andes the year round. Much of the precipitation falls on the crests as snow, and the snow changes to ice in every valley. Hence the coast has many glaciers and icebergs. Moraines across the valleys hold back water from the glaciers above and form many beautiful lakes. (*See also* Chile.)

2. THE ORINOCO RIVER BASIN

The great arc of the Andes in Colombia and Venezuela makes a rim around the northern and western edges of the Orinoco basin, an area of about 365,000 square miles (*see* Orinoco River). The southwestern part lies in Colombia, the remainder in Venezuela. From the Orinoco north to the coastal ranges the savanna (*llanos*) is grass-covered, with trees along the many streams.

In summer, which occurs here at the same time as in North America, the entire basin lies in the belt of drenching equatorial rain and much of the land becomes a swamp or inland sea. In winter the llanos get little rain, and become dry and brown in the tropical heat. These conditions are a great handicap to cattle raising, which is the chief occupation. Insect pests, disease, poor transportation, and limited local demand for meat and hides are further drawbacks. The population is sparse, and consists mostly of Indians. (*See also* Colombia; Venezuela.)

3. GUIANA HIGHLANDS AND COAST

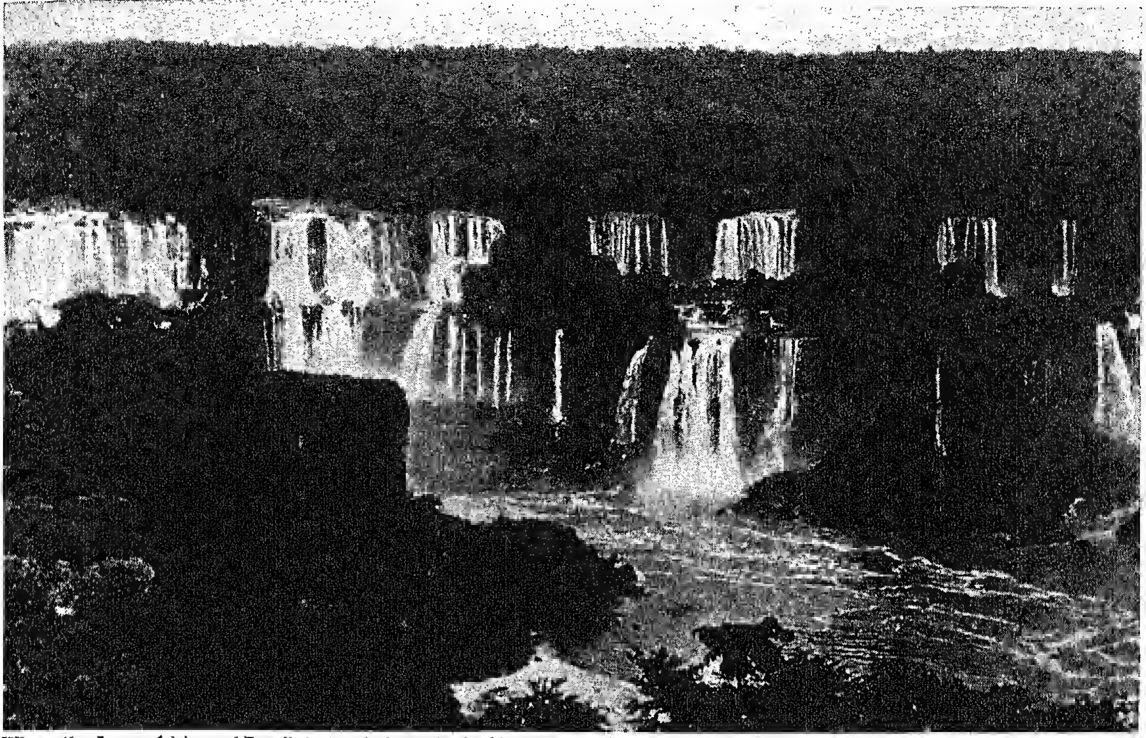
Southeast of the mouth of the Orinoco River the Guiana Highlands extend over nearly 700,000 square miles. The backbone of this region is one of the "islands" of old rock which form the foundation of eastern South America. Politically it is shared by Venezuela, Brazil, and the Guianas. Many of the mountains have been worn to rounded, domelike shapes by the wash of tropical rain through the ages. Only a few of them rise more than 5,000 feet. They contain gold, diamonds, bauxite (aluminum ore), manganese, and mica. Between the mountains is a tangle of streams, with tropical forest wherever trees can find a foothold. Superb waterfalls mark the descent of the rivers from the mountains.

From this mountainous core, the land slopes off toward the north into a plateau, and then down to a narrow coastal fringe. Here the climate is steaming hot, with tropical rain from May to October and trade-wind rain in the remaining months. Agriculture is confined to clearings. Extensive diking and drainage are necessary. Sugar is the principal crop, with rum and molasses as by-products. Rice, bananas, and coffee are also grown. The forests are rich in cabinet woods and balata. (*See also* Guiana.)

4. THE AMAZON RIVER BASIN

Into the Amazon River drains heavy rainfall from an area estimated at 2,500,000 square miles. The headwaters in the Andes belong to Colombia, Ecuador,

THE BROAD AND MAJESTIC IGUASSÚ FALLS



Where the Iguassú River of Brazil descends from the highlands to the Argentine plains, it drops about 200 feet in one of the world's grandest cataracts. The falls are about two and a half miles wide. A few miles below, the Iguassú joins the Paraná.

Peru, and Bolivia; the rest of the basin belongs to Brazil. A neighboring basin of about 345,000 square miles in Brazil is drained by the Tocantins River, which is called the Pará where it flows into the Atlantic. The Pará is separated from the Amazon by Marajó Island, which is as large as Maryland.

All year long the temperature holds to a daily average between 75° and 80° F. In most localities the precipitation is about 80 inches a year, but in some places it rises to 150 and even 200 inches. This hot, wet climate has filled the region with the world's greatest tropical rain forest, or *selva*. During the rainy season from December through April the rivers rise 20 to 50 feet higher than their low-water level, and floods cover hundreds of thousands of square miles. The northern part of the basin lies on the southern slope of the Guiana Highlands, and has a dry season, just as do the llanos of the Orinoco.

The soil is mostly of the laterite type and not good for agriculture (*see* Soil). It loses fertility after one or two crops, and the natives have to clear fresh land nearly every year for their little patches of crops. Because of the enervating climate, insect pests, and tropical diseases, the vast region is left largely to the Indians and people of part Indian blood. The few whites live mostly in towns and plantations along the rivers. They ship rubber, timber, Brazil nuts, and other forest products. The Ford Motor Company maintains rubber plantations on one of the tributaries of the Amazon, the Tapajóz, about 150 miles south of the town of Santarém. (*See also* Amazon River; Brazil.)

5. THE BRAZILIAN HIGHLANDS

The "bulge" of Brazil, east and south of the mouth of the Amazon River, has as a foundation the old worn-down mountains of the Brazilian Highlands. Most of it is a rolling plateau, averaging about 3,000 feet above sea level. The highest peaks range between 7,000 and 9,400 feet. This elevation gives some relief from the tropical heat which prevails at sea level. From May to November, the southeast trade winds yield good rainfall as they mount to the plateau. Over the plateau, the effect of rising ground ceases, and local thundershowers produce only from 10 to 20 inches of rain for the winter season. In summer, from November to April, the belt of equatorial rain lies over the region and doubles the amount of rain.

A striking exception to this climate occurs in the semiarid *caatinga* region, in the north. This region is lower than the plateau to the southeast, and hence receives no steady rainfall from the trade winds. Thundershowers occur, but they are erratic. The general dryness is aggravated by lack of plant cover on the land. Rain runs off or evaporates almost as fast as it falls.

By far the most important portion of the Brazilian Highland is the Central Plateau of eastern Brazil. On or near its margin are the largest cities, much

of the manufacturing and trade, and a large part of the population. The interior produces more than half of the world's coffee. The southern portion of the coastal strip and the adjoining highlands also grow cotton, sugar, rice, beans, tobacco, and cacao. On the northern and western slopes of the highlands, an important live-stock industry has developed. (*See also* Brazil.)

6. THE PARAGUAY-PARANÁ PLAINS

West and south of the Brazilian Highlands lies the most important lowland region in South America. Much of the northern portion is occupied by the Gran Chaco. The southern portion is the Pampa, the only moderate-climate lowland on the continent. The rest consists of the rolling grassy plains of Uruguay, eastern Paraguay, and the Argentine Mesopotamia.

The Wild Chaco and Its Resources

The Gran Chaco ("hunting ground") is shared by Paraguay, Bolivia, and Argentina. Its total area is about 400,000 square miles. Here the hot, wet climate of the tropics changes to the cooler and drier climate of the middle latitudes. In summer it receives heavy rain as far south as the Pilcomayo River and good rain farther south. Then the generally flat land is flooded and the sluggish, shallow rivers thread their way through extensive swamps. In winter, the rainfall is only between 10 and 20 inches along the Paraná River, and decreases to almost nothing in the west. The heat and abundant stream water are enough, however, to support a dense forest of subtropical trees along all the rivers. The most valuable tree is the quebracho. Between the rivers is grassland. The foundation of sedimentary rock contains petroleum. Until recently the Chaco has been left to the Indians, except for a few traders and immigrants.

The Rich and Populous Pampa

South of the Gran Chaco lies the flat prairie land called the Pampa. Most of this region of about 250,000 square miles is much like the plains of North America between the Missouri River and the Rocky Mountains. It supports a population about equal to that of Texas, Oklahoma, Kansas, and Nebraska, chiefly by growing grains and live stock. The westerly winds bring little rain, for they have dropped most of their moisture on the high mountains; but cyclonic storms draw moisture enough from the Atlantic for grass and wheat.

The western margin of the Pampa, where the plain merges into the Andes, is a dry, broken region called the *monte*. It stands a mile or more above sea level, and the rainfall in many places is less than ten inches a year. Irrigation from artesian wells and some of the short rivers from the mountains produces special crops such as the grapes grown around Mendoza.

The southern part of Uruguay is a plain like the Argentine Pampa; the rest is a rolling grazing land. A rainfall ranging from 35 to 60 inches a year supports trees along the streams and rich grass everywhere. The temperature ranges between an average of 71° F. in summer and 50° F. in winter, with rare frosts.

Thanks to their agricultural possibilities and the favorable climate, these plains support a large population. They have two large cities, Buenos Aires and Montevideo, as well as many smaller ones. (*See also* Argentina; Paraguay; Uruguay.)

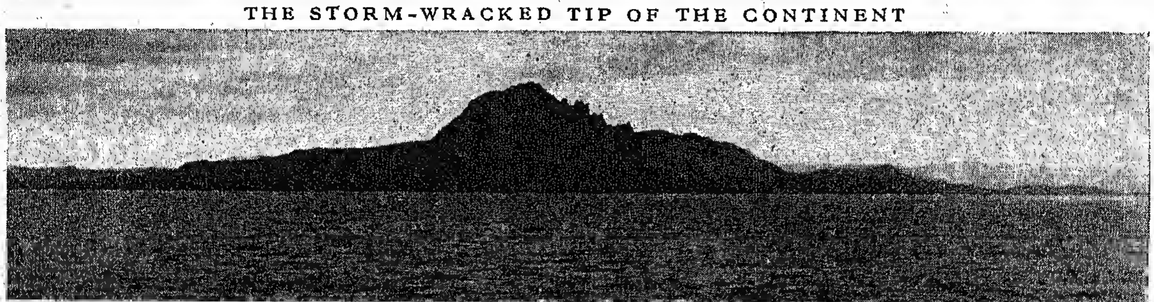
7. THE PATAGONIAN TABLELAND

South of the Colorado River, the plains rise to the plateau of Patagonia, which is nowhere higher than 5,000 feet. This is a vast bleak region of more than 300,000 square miles, nearly all belonging to Argentina. The land is deeply carved by rivers fed with melted snow from the Andes. Rainfall ranges from 8 inches in the central portion to 60 inches in the south. Raising and slaughtering sheep is the only considerable industry. (*See* Patagonia.)

South of the Strait of Magellan a continuation of the old plateau has sunk until only mountain tops rise above the water. These, with the drowned southern tip of the Andes, form the archipelago of Tierra del Fuego, or "land of fire," so named by the discoverer, Magellan, from the many native camp fires observed. The region is divided between Argentina and Chile. Over most of it precipitation is plentiful. Because of the surrounding ocean, the temperature does not drop on the average below 31° F. even in the depth of winter in July. Sheep and cattle are raised and some beech and pine are cut.

On one of the southernmost islands is Cape Horn, the tip of South America. Here the westerly winds have an unbroken sweep around the earth and acquire terrific force. Howling gales and mountainous seas usually greet the few mariners who try to round the Horn. In sailing-ship days, this passage was considered one of the most hazardous in all the world.

THE STORM-WRACKED TIP OF THE CONTINENT



This view of Cape Horn is one of the rarest photographs ever taken. The Cape is wrapped in almost perpetual mist and storm and the few ships that brave its roaring gales seldom catch more than a glimpse of the gaunt outline.

The Varied Array of Plants and Animals

HUMAN ACTIVITY throughout the continent has been strongly influenced by the native plants and animals. In the equatorial forests plants grow so rankly that they almost crowd man out. On the other hand, the fertile grasslands of the Argentine Pampa have drawn millions of immigrants. Of great significance too for the life of the original Indian inhabitants was the fact that they had no horses or cattle until the white conquerors brought them from Europe.

South America is the native home of many plants of vast importance to the world. Among its gifts to mankind are rubber, several varieties of cotton, tagua nuts (vegetable ivory) for buttons, and the quebracho extract which is one of our most useful tanning materials. South American food plants which have spread to other parts of the world are potatoes, sweet potatoes, tomatoes, kidney and lima beans, peanuts, and manioc or cassava from which we get tapioca.

Among the beverages and flavoring materials that we owe to South America and tropical regions of North America are cocoa and chocolate, cola drinks from the kola nut, sarsaparilla, vanilla, and the tonka bean. In the list of drugs are quinine, cocaine, ipecac, and various balsams.

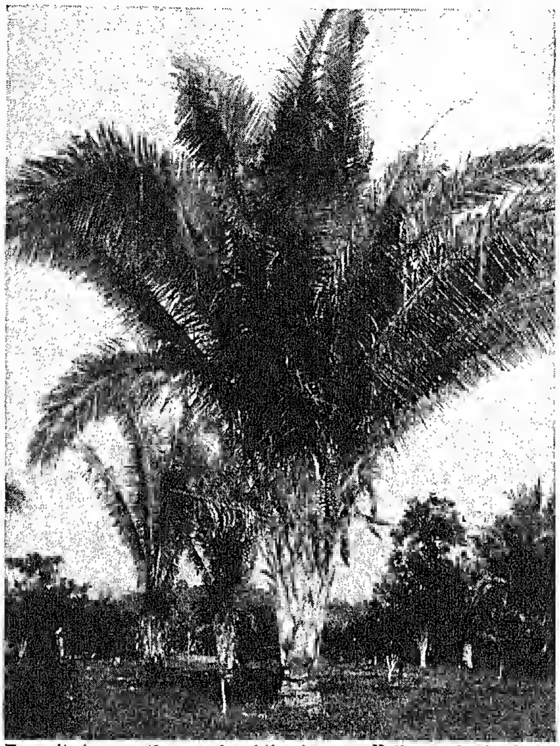
Some of the native animals yield fine fur and wool. Most important of these are the llama and its relatives, the alpaca, the vicuña, the *misti*, and the *huarizo*. The last two are crosses between the alpaca and the llama. Other animals prized for their fur are the chinchilla, the coati, the fox, the jaguar, the leopard cat, the nutria or coypu, the otter, the ocelot, the puma, the raccoon, the skunk, and the wolf. The guanaco, once a source of both fur and wool, is now scarce. The peccary, or wild pig, furnishes fine leather for gloves; and snakeskins are made into women's shoes and other articles.

Life in the Amazon Rain Forest

The greatest variety and profusion of plant and animal life are found in the equatorial rain forest, or selva, within 10 degrees of the Equator. Most of this rain forest is in the basin of the Amazon, but there are similar forests in parts of the Orinoco basin and Guiana, on the Pacific coast north of the Equator, and on parts of the Caribbean coast.

Almost everywhere in the Amazon basin, except on the margin, the continuous heat and abundant moisture have packed trees and other plants as closely together as they can find footing and a bit of sunlight. Men can scarcely squeeze between the towering tree trunks. Whatever open space is left is laced across with lianas (stout vines). Plants which would be only bushes in more open country here grow to considerable height to reach sunlight. The slimy ground below is covered with plants which can live without much light.

THE USEFUL BABASSU PALM



From its leaves, the people of the Amazon Valley make baskets, mats, and sandals. Its trunk serves as firewood. From its nuts they get food and oil. The oil is a valuable export.

Among the tallest trees are the castanheiro, source of Brazil nuts; the sapucaya or cream-nut tree; the silk-cotton tree (kapok); and various fig and garlic trees. One species of fig tree (*Hevea brasiliensis*) yields the latex or milk which gives us rubber (*see* Rubber). The vegetation of medium height includes palms, the wild chocolate or cacao, bamboo, and wild plantains. The ground level is packed with ferns, begonias, pansies, iris, and members of the amaryllis, lily, and pineapple families. Most of the trees are hardwoods, but they remain green the year round and do not shed their leaves. Among them are valuable furniture woods, such as rosewood and snakewood. Other useful trees and shrubs are the castilloa, which yields an inferior rubber called *caucho;* the bullet tree, which yields balata; various palms, such as the babassu, whose nuts furnish oils; the *Dipteryx odorata*, which gives us the tonka beans used as a perfume base and a substitute for vanilla; and the cassava or manioc shrub.

Where rivers break the forest, gorgeous flowers line the banks. The water is covered with water-lilies, including the giant *Victoria regia* (for picture, *see* Water-Lily). In the lowest and most swampy portions of the basin, mangroves strike their many branchlike roots into the ground. Orchids grow everywhere, high on the trees.

Swarming Mammals and Birds among the Trees

Rich vegetation, plentiful water, and continuous heat produce an abundance of those animals that can get about in the forest. But large mammals are few.

The largest is the tapir; it lives in the giant cane grass along the edges of streams. The trees are thronged with monkeys. Jaguars, pumas, and ocelots are among the cats. Other flesh-eating mammals are kinkajous, otters, ferrets, and a few weasels.

MYSTERIOUS BEAKS

No one knows why the toucans have such big beaks. Numerous species live in the tropical forests, the largest about two feet high.

Squirrels, rats, mice, porcupines, and other rodents abound. Among them is the largest rodent known, the capybara, which the natives eat. The paca, a spotted rodent about two feet long, is also highly prized as food. Another gnawing animal is the paca's close relative, the agouti.

The equatorial forest is a paradise for birds. Parrots, macaws, toucans, and other fruit-eaters fill the trees. At night the air is filled with whippoorwills and other goatsuckers, gorging themselves on insects. By day, hawks and eagles are alert for live prey, while vultures soar about, watching for carrion. Woodpeckers hammer at the trees, and the streams swarm with water birds—ducks, geese, herons, egrets, spoonbills, ibises, and storks.

Insects, Reptiles, and Fish

Few regions have so many and such gorgeous insects. In the neighborhood of Belém (Pará) twice as many kinds of moths and butterflies are found as in all Europe. Fireflies light the night with red, yellow, and green flashes; cicadas maintain a constant din. The ground and plants are alive with destructive ants, cockroaches, and termites. Flies, gnats, and ticks make life miserable for man; and mosquitoes infect him with malaria and yellow fever. Beetles are headed by the *Titanus giganteus*, which is 5 or 6 inches long. Hornets, wasps, and stingless bees are common.

Lizards flick about everywhere. Other common reptiles are constrictor and poisonous snakes, water snakes, turtles, and alligators. The tartaruga turtle is a native mainstay for food. The Indians also eat the deadly bushmaster, a snake similar to the rattlesnake.

Fish of perhaps 2,000 species fill the waters. The most dangerous are electric eels and the flesh-eating piranha. A school of these small fish will in a few moments devour the largest animal that may venture into the water where they lurk, provided only that a scratch or wound first gives them a taste of blood. The huge-mouthed *pirarucu* or *arapaima* is the principal food fish. Some specimens are 15 feet long and weigh 500 pounds.

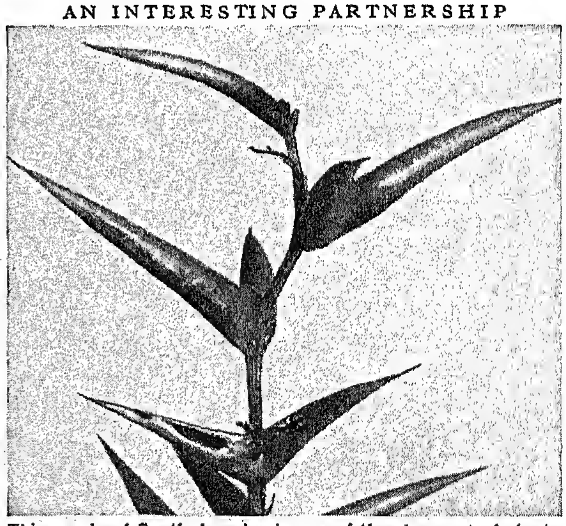
"Living Fossils" and Other Strange Animals

The protection of the tropical forest has enabled many strange and primitive types of animal to survive. Among birds is the hoatzin or ama, with claws on its wings like those of the fossil *Archaeopteryx*. Both giant and pigmy armadillos are found. Several species of ant-eaters find rich living, and their relatives the sloths have taken to the trees. A queer-looking cow-faced mammal, the manatee or sea-cow, lives in shallow coastal waters and in the rivers. The Indians hunt it for its porklike flesh. Opossums range from the size of mice to the size of a cat. Among the swarming bats are blood-sucking vampires. The tarantula spiders are large enough to hunt birds.

Life in Other Equatorial Rain Forests

As the slopes of the Andes rise from the western margin of the Amazon basin, palms gradually disappear and other types of vegetation take their place. Among these are giant ferns, and the cinchona trees which once furnished the world supply of quinine but are now scarce. On the Pacific coast of Ecuador and Colombia, the narrow strip of equatorial rain forest contains the tagua or ivory-nut palm, the toquilla palm, the castilloa tree, and the silk-cotton or kapok tree. Here too is the balsa tree, which furnishes a tough wood far lighter than cork.

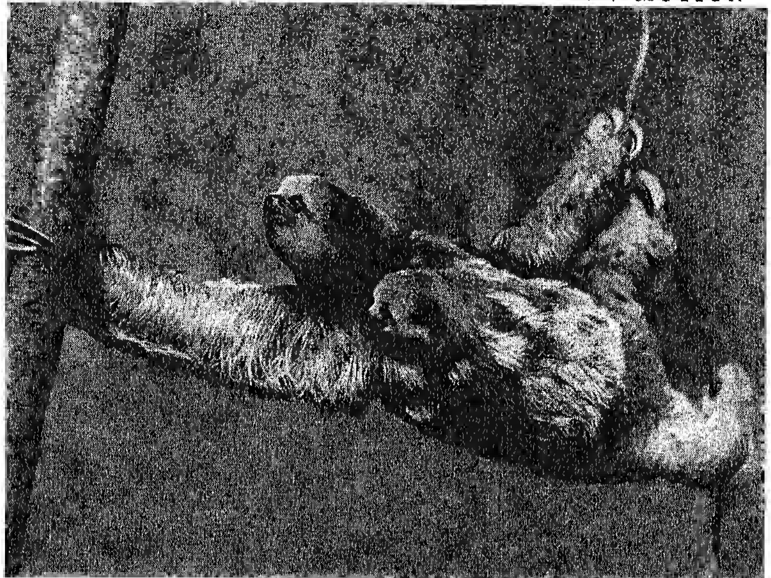
AN INTERESTING PARTNERSHIP



This acacia of South America is one of the cleverest of plants. In its hollow thorns it provides a home for certain flesh-eating ants, which serve as the plant's guardians, driving away all leaf-cutting ants which might injure the acacia.

To the north and east, the Caribbean forests of Colombia and Venezuela have many fine furniture and specialty woods. Among the products of the Guiana forest in the extreme northeast are balata and several kinds of valuable cabinet woods that await develop-

THREE-TOED SLOTH, CHAMPION OF SLOW MOTION



Natives of the Amazon forest call this animal the "ai" from its sharp cry. Like the others of the family, this mother and baby spend all their time among the branches of trees, crawling upside down with unbelievable slowness in search of the leaves they feed on.

ment in world markets. (*See also* Amazon River; Brazil; and Fact-Index entries on the principal plants and animals.)

The Tropical and Subtropical Savannas

North and south of the Amazon rain forest are the tropical and subtropical grasslands called savannas. These are the *llanos* of Venezuela, the *campos* of Brazil, and the Gran Chaco of Bolivia, Paraguay, and Argentina. In the rainy season the grass grows to the height of a man. Here and there are thorny shrubs and low trees. One of the palms, the carnauba or wax palm of the Brazilian Highlands, is commercially important. The wax from its leaves resembles beeswax, and is exported for use in electric insulation and for other purposes. In the semiarid northeastern part of the Brazilian Highlands, grass gives way to a dreary tangle of cacti, acacias, and other thorny shrubs (*caatinga*). In southeastern Brazil are forests of Paraná pine and a holly bush which yields *yerba maté*. The Paraná pine, or araucaria, is the continent's most important softwood, and *yerba maté* its characteristic beverage. The latter is also abundant in the Chaco, along with quebracho trees and palms.

Animal life consists generally of the hardier tropical species, such as ant-eaters, tapirs, and armadillos; with some running animals, such as deer. The huge running bird, the rhea, can also be found in the open spaces of Paraguay, and occasionally in western Brazil and outlying parts of Uruguay and Argentina.

Wild Life of the Pampa

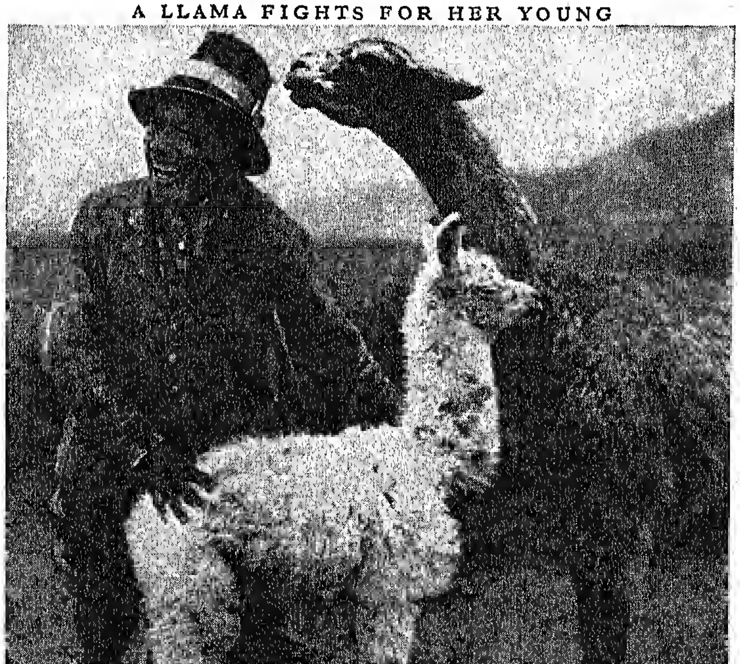
On the Pampa, the comparative dryness confines the native plant life to grasses, except on the margin. Near the Paraná, the evergreen *ombu* provides a welcome shade. In the north and northeast is a straggling fringe of subtropical trees and bushes. But the sycamore, the eucalyptus, and other trees do well when men plant them for shade and windbreaks. Patagonia too is predominantly grassland.

Hares, deer, armadillos, foxes, and skunks are common. The puma and the guanaco, once abundant, are now scarce. The birds include hawks, owls, partridges, plovers, and the rhea. Near the rivers live ducks, geese, herons, and storks. The rivers support trout, salmon, eels, and an excellent food fish called the *pejerrey*.

On the High Mountains and Islands

Throughout the length of the Andes, the lower slopes share the life of the adjoining lowland. At greater elevations, the life gradually changes until on the cold, windswept heights only the hardiest of ground

A LLAMA FIGHTS FOR HER YOUNG



This mother llama is expressing her resentment by spitting at the laughing herdsman. Llamas have been domesticated since long before the Spanish conquest. But they are stubborn, and it takes an experienced handler to get them to do their work.

growths survive. On the high plateaus, mosses, lichens, and the tough *ichu* grass are the principal plants. In Peru and Bolivia the resinous, mosslike *yareta* and the bushy evergreen *tola* supply fuel. The *totora* reeds of Lake Titicaca are woven into boats called balsas. The most important native animals are llamas, alpacas, vicuñas, and guanacos of the camel family; and a fur-bearing rodent, the chinchilla. Birds include ducks and other game birds; the meat-eating hawks, eagles, buzzards, and majestic condors. Sheep and goats live wherever men have introduced them.

Some of the islands off the coasts offer splendid havens for birds and, when moist enough, for plant life. The Galápagos Islands, 600 miles from Ecuador, have a remarkable array of animal species found nowhere else. They are especially famous for their giant tortoises.

The Lobo, Chincha, and other small islands off the Peruvian coast are all but covered with the nests of fishing birds—cormorants, gulls, boobies, pelicans, and many others. Through the centuries, the droppings (guano) of these birds covered the islands to a depth of from 40 to 150 feet. This guano is the richest nitrogenous fertilizer known. During the 19th century most of it was stripped away and future supplies were endangered. The Peruvian government now keeps each of the islands closed in turn, and protects the birds.

Along the coast of Chile the cold Humboldt Current attracts Antarctic birds and seals. On much of Tierra del Fuego and the Falkland Islands, where the constant wind hinders tree growth, the land is covered with tussock grass six or seven feet high.

Four and a Half Centuries of Eventful History

SOUTH AMERICA was discovered by Christopher Columbus in 1498. That year Columbus, on his third voyage to the New World, touched the continent at the mouth of the Orinoco River. Other navigators soon followed. In 1499 Alonzo de Ojeda, also in the service of Spain, explored most of the eastern coast north of the mouth of the Amazon River. He was accompanied by Americus Vespucius, whose name was given to the continent (*see* Vespucius, Americus). In separate expeditions the following year Vicente Pinzón, for Spain, and Pedro Alvares Cabral, for Portugal, sighted the coast of Brazil. By 1520, when Magellan sailed triumphantly into the Pacific, the entire Atlantic coast of South America had been explored. (*See also* America.)

With exploration came conquest and settlement. By the Treaty of Tordesillas (1494), Spain and Portugal had divided the New World between them. Portugal received the eastern part of the continent to a line that roughly coincides with the 50th meridian; Spain received the rest. Lured by the promise of fabulous wealth, Spanish and Portuguese adventurers braved all dangers to win riches in their new lands. In 1509, more than a century before the Pilgrims set foot in Plymouth, Ojeda established a colony on the north coast of Colombia. Pizarro, bold and ruthless, wrested Peru from the Incas in 1533 (*see* Incas; Pizarro, Francisco). Another Spaniard, Francisco de Orellana, spanned the continent in 1541, crossing the Andes and following the Amazon to the Atlantic. By the end of the 16th century, most of the great South American cities had been founded.

Colonial Life and Government

For two centuries, all of Spain's territory in South America, except Venezuela, was included in a single unit called the viceroyalty of Peru. But, because administration of so vast an area proved difficult, other viceroyalties were created in the 18th century. Then the viceroyalty of New Granada comprised the northern part of the continent; the viceroyalty of Peru, most of the western coast; and the viceroyalty of La Plata, the central and southern part.

The Spanish colonies were ruled from Spain by the Council of the Indies, set up at Seville in 1524. In the colonies, the viceroy exercised supreme power and often dominated the *audiencia*, the advisory council and supreme court of the viceroyalty. The important unit of social and economic life was the *encomienda*, one or more Indian villages governed by a Spaniard. The proprietor (*encomendero*) ruled the Indians almost as serfs, but was responsible for their education and religious instruction. The *encomienda* was abolished late in the 18th century, but the great estates of today are a survival of the system.

Colonial commerce, traffic, and immigration were controlled from Spain by the *Casa de Contratación* (House of Trade) until 1790. Trade was rigidly regulated for the benefit of the mother country, and non-Spanish immigrants were excluded.

For about three centuries, mining was the chief occupation of the Spanish colonies, except around the Rio de la Plata. Agriculture supplied little more than local needs. The Spanish king enjoyed huge revenues from the colonies by exacting his "royal fifth" of all the precious minerals discovered or mined; by exercising monopolies; and by taxing sales.

Portugal's colonial government was at first less centralized than Spain's. The king of Portugal divided Brazil into "captaincies," governed by landed proprietors who had almost absolute authority. In the latter half of the 18th century, however, the governor general, responsible directly to the king, assumed almost complete power. Taxes were heavy, and trade was rigidly controlled by the home government. The Portuguese, who settled the land and developed farms, were on the whole better colonists than the Spaniards, who tried mainly to win sudden fortunes from mining. But the development of large plantations, which became the chief units of social life, fastened upon Brazil until 1888 the evils of Negro slavery.

The Colonies Win Independence

By the close of the 18th century, revolution was brewing in the Spanish colonies. The *criollos* (creoles), as the colonial-born whites were called, grew to hate the *peninsulares*, the officials sent out from Spain, for monopolizing the important and well-paid

offices. The *peninsulares*, by refusing to make concessions to the creoles, forced them into an alliance with the mestizos. Thus was born a strong colonial group demanding the right to govern itself. This demand was intensified by the fact that the high taxes and vexatious trade restrictions of the mother country drained off the wealth of the colonies and stifled enterprise. Furthermore, the success of the American and the French revolutions inflamed the young creoles, many of whom were well versed in the political and social doctrines emerging in the 18th century.

The Napoleonic wars in Europe set the stage for revolt in South America. Beginning in 1808 when Napoleon placed his brother Joseph Bonaparte on the throne of Spain, the colonies took advantage of the situation to set up their own governing bodies called *juntas*. In 1811 Venezuela, under the leadership of Francisco de Miranda, declared its independence, and other colonies soon followed its lead. In 1812, however, the new republic organized by Miranda was overthrown, and its leader sent to Spain, where he died in prison.

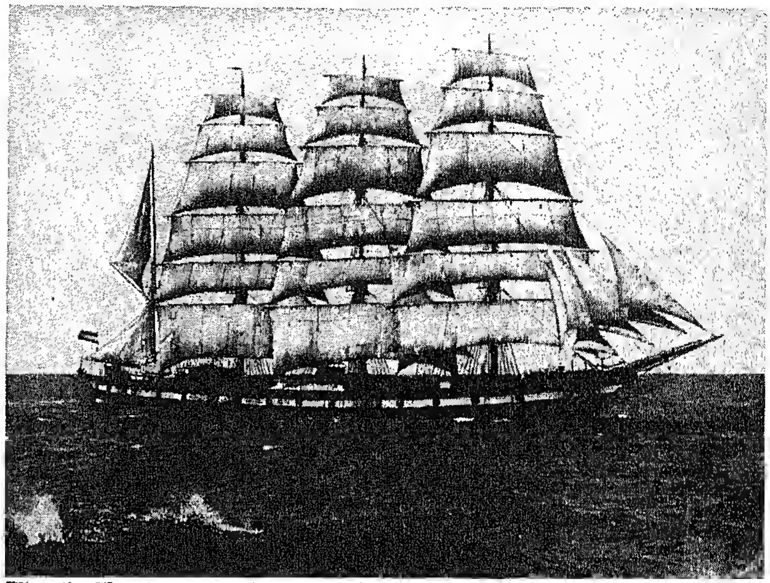
But in 1817 the revolution moved toward a successful conclusion with the start of military campaigns by the great leaders, Gen. Simón Bolívar, in the north, and Gen. José de San Martín, in the south. Aided by Gen. Bernardo O'Higgins, San Martín freed Chile from the royalists by 1818, and by 1822 he had liberated southern Peru. Bolívar freed Venezuela from Spain in 1821, and then with the help of his general, Antonio José de Sucre, went on to free the other Spanish-dominated countries in the north. With the fall of Callao in 1826, South America's struggle for liberation from Spain was won, less than 15 years after Venezuela had declared its independence. The entire continent was free from European rule, except for the Guianas, which Spain had lost to England, France, and Holland in the 17th century. Brazil had declared its independence in 1822, and thenceforth was a constitutional monarchy until 1889, when it became a republic. Thus ten new nations were born. Argentina, Uruguay, Paraguay, and Bolivia arose out of the old viceroyalty of La Plata; Colombia, Venezuela, and Ecuador, out of the viceroyalty of New Granada; Chile and Peru, out of the viceroyalty of Peru.

Problems of the Young Nations

After winning their struggle for freedom, the new American nations faced the immense problem of governing themselves. Inspired by the ideals of the French and American revolutions, the Spanish countries, and later Brazil also, adopted a republican form of government, though they generally accorded greater power to the president than did the United States.

But, after centuries of colonial subjection, the young republics were ill-prepared for democracy. Economic life was semifeudal and agricultural with little manufacturing or foreign trade. Bitter antagonism existed between the large landowners, who generally belonged to the Conservative party, and the members of the Liberal party who sought industrial progress and social reform.

A "CAPE HORNER" OF THE 19TH CENTURY



When the West Coast countries depended on sailing ships like this to connect them with the rest of the world, they were among the most isolated regions of the globe. The fastest ships took nearly four months to reach them via Cape Horn from Europe or the United States. Now we can reach them in four days by air.

These conditions gave rise to periodic revolutions and dictators. Strong men, called *caudillos*, frequently led their followers in armed seizure of power. They abolished all opposition and ruled by stern and dictatorial methods. So typical and widespread were the *caudillos* that the 19th century has been called the "age of dictators."

The vaguely defined boundaries were the subject of conflicting territorial claims. Over such disputes, irresponsible leaders sometimes plunged their nations into war. Two devastating conflicts were the Paraguayan War (1865–70), in which Brazil, Argentina, and Uruguay conquered Paraguay; and the War of the Pacific (1879–84), in which Chile defeated Peru and Bolivia. On the whole, however, the South American nations have been outstanding in settling their disputes by peaceful means.

Rise of Modern Nations

But even as the nations were being rocked by wars and revolutions, there began to emerge a more stable and democratic order. A decisive factor was the opening up of the continent to foreign capital and immigration. After the middle of the 19th century, British and American investors spent billions of dollars in

developing its vast resources. Millions of immigrants poured in from all parts of Europe.

Recent History and Present Forms of Government

In the World War of 1914–1918, Brazil was the only South American nation to declare war on Germany. After the war, all ten republics joined the League of Nations. The entire continent enjoyed a rapid expansion of trade as a result of the wartime demands for raw materials and foodstuffs. Postwar prosperity collapsed, however, in the world depression beginning in 1929. Economic difficulties brought a revival of political strife, which was intensified by the chaotic international situation. After 1933 the South American nations joined with the United States and the other republics of the Western Hemisphere in creating a strong Pan American movement. The outbreak of a general war in Europe in 1939 solidified the movement and brought forth concrete measures for continental defense. (*See also* World War, Second.)

Most of the present-day constitutions of South America are modeled after that of the United States. Seven of the republics have a centralized system of government. Argentina, Brazil, and Venezuela have a federal system, in which the national government exercises only those powers delegated to it by the constitution, with the remaining powers reserved for the states. In all countries, the chief executive is the president. His term varies from four to seven years. The constitutions provide for popular elections of a senate and of a lower house, usually called the Chamber of Deputies. The vote is generally accorded to all male citizens over 21, though some republics exclude the illiterate. Women can vote in a few countries.

(For further information about the people of South America, their history and culture, *see* Latin America; Latin American Literature. For geography, industries, and trade, *see* articles on the various countries. *See also* **South America** in the FACT-INDEX at the end of this volume.)

—REFERENCE-OUTLINE *for Organized Study of* SOUTH AMERICA—

SOUTH AMERICA is a continent of opportunities. Endowed with unlimited natural resources, every variety of climate and land formation, rich mineral deposits, great rivers, vast forests, and fertile plains, the southern half of the New World may look forward to a future of ever-increasing prosperity and power. The new nations which sprang up from the ashes of foreign misrule have suffered from internal disorders and the blights of war. Today, however, the South American nations have for the most part begun to build on a solid foundation, developing their own resources with the constructive aid of foreign capital, and providing for the education of their people. Many South American cities are models of the most recent developments in engineering, sanitation, schools, and transportation.

I. **PHYSIOGRAPHY: S-205*a*, S-205*c*.**

A. **Relation to North America and Europe: S-205*b* map.** Effect of Geographic Position and Land Features upon Settlement and Trade S-205*b*, S-205*h*, S-206*d*, L-67*d*.

B. **Mountains and Highlands: S-205*a*, S-205*c*, S-208*d* map.**
  - a. **Andes the Continental Backbone: A-194, S-205*f*.** Aconcagua, Highest Peak A-10; Earthquakes, Volcanic Eruptions A-195, E-135, C-206, C-306.
  - b. **Brazilian Highlands: S-208*g*, B-225.**
  - c. **Guiana Highlands: S-208*f*, G-183.**
  - d. **Patagonian Plateau: S-208*h*, P-84, A-280*a*.**

C. **Lowlands: S-205*c*, S-208*d* map.**
  - a. **Amazon Basin: S-208*f*, A-139, B-226*b*.**
  - b. **Caribbean Coast: S-208*f*, G-182.**
  - c. **Llanos: S-208*f*, V-274.**
  - d. **Pacific Coast: S-208*e*, S-208*f*, C-206, E-155, P-137.**
  - e. **Paraguay-Paraná (Chaco, Pampa): S-208*h*, A-278, A-280, P-66, U-262.**

D. **Rivers: S-205*c*, S-206*d*.** Amazon A-139; Atrato, Cauca, and Magdalena, C-306, C-206*e* picture; Orinoco S-208*f*, O-250; Plata and Tributaries P-246, A-280, P-66, P-67, U-262.

E. **Coast Line and Islands: S-205*a*, S-205*e*.** Chilean Archipelago S-205*e;* Falkland Islands F-7; Galápagos Islands E-154, S-205*e;* Juan Fernandez Islands C-407; Tierra del Fuego Group S-208*h*, C-207*b;* Trinidad T-141.

II. **CLIMATE: S-205*e*.**

A. **Heat and Cold: S-205*b*, S-205*g* map.**

B. **Precipitation: S-208*g* map, S-208*d* map, R-47 map.**

C. **Regional Climates:**
  - a. **Tropical Rain Forests:** Amazon Basin S-208*f*, A-139, B-226*b;* Guiana S-208*f*, G-182; North Pacific Coast S-208*e*, E-155.
  - b. **Subtropical and Temperate Forests: S-208*f*, S-208*h*, B-169, C-207*b*, P-66.**
  - c. **Tropical and Subtropical Dry Forest, Scrub, and Savannas:** Caatinga S-208*g*, B-226*b;* Chaco S-208*h*, A-280, P-66; Llanos S-208*f*, V-274.
  - d. **Middle-Latitude (Temperate) Dry Forest, Savannas, and Grasslands:** Monte S-208*h;* Pampa A-278.
  - e. **Hot Desert: S-208*f*.** Chile C-207; Peru P-137.
  - f. **Mountain (Cold) Desert: S-208*k*.**

III. **PLANT AND ANIMAL LIFE: S-208*i*.**

IV. **PEOPLES OF SOUTH AMERICA: S-205, S-205*b*, L-67*b*, L-67*d*.**

A. **Distribution of Population: S-208*d* map.** Cities S-206*d*, S-205*h*.

B. **Predominantly White Populations: S-205*c*, A-280*a*, B-226, U-262.**

C. **Mixed Populations: B-170, B-226*c*, C-207*d*, G-183, V-276.**

D. **Indians: S-205*h*, I-52.** Incas I-27.

V. **AGRICULTURE AND FOREST PRODUCTS: S-206*f*.**

A. **Tropical and Semitropical Crops:** Brazil B-226; Caribbean Coast S-208*e*, S-208*f*, C-306, G-183, V-276; Interior S-208*f*, A-280, B-169, P-67; Pacific Coast E-155, P-138.

B. **Middle-Latitude Grains and Fruits: S-207, A-278, A-280*a*, A-280*b*, C-207*a*.**

C. **Forest Products:** Tropical and Semitropical S-207; S-208*i-k*, B-170, B-226*b*, C-306, E-155, G-183, P-138; Middle-Latitude C-207*b*.

D. **Animal Products: S-207, S-208*i*.** Andean Plateaus P-138; Brazil B-226*c;* Chaco P-66; Chile C-207*b*, C-207*c;* Llanos S-208*f*, V-274; Pampa A-280*b*, U-262; Patagonia and Tierra del Fuego S-208*h*, A-280*a*.

VI. **MINERAL RESOURCES: S-207, A-195.** Bolivia B-170; Brazil B-226*a*, B-226*d;* Chile C-207, C-207*a*, C-207*b;* Colombia C-306; Guiana G-183; Peru P-138, P-140, Venezuela V-274, V-276; Chief Minerals C-357, D-59; G-111, P-151, P-146 map, P-247, S-152.

VII. **MANUFACTURING AND TRADE: S-206*d*, S-206*f*, L-67*n*.** Argentina A-280*c;* Brazil B-226*d;* Chile C-207*b;* Peru P-140.

VIII. **TRANSPORTATION AND COMMUNICATION: S-206*d*.** Waterways S-206*d*, A-280*d*, B-226*d;* Railroads S-206*e*, A-280*d*, B-227, C-207*c;* Airplanes S-206*e*, B-227, C-207*c;* Roads S-206*f*, A-280*d*, B-227, C-207*c;* Telegraph, Telephone, and Radio S-206*f*, A-280*d*, B-227.

IX. **SOCIAL INSTITUTIONS AND THE ARTS: S-205*b*, S-206*d*, L-67*b*.** Architecture L-67*j;* Fine Arts L-67*j-k;* Literature L-67*i*, L-67*s;* Education L-67*b*, L-67*h*, L-67*k*.

X. **INTERNATIONAL TRADE AND POLITICAL RELATIONS: S-206*f*, S-207, S-208, S-208*e*, L-67*m*, L-67*o*.** Monroe Doctrine M-241; Pan American Union L-67*q*.

XI. **HISTORY: S-208*l*, L-67*e*, L-67*g*.**

A. **Discovery and Exploration: A-142, A-143 map.** Columbus C-319, G-183; Vespucius V-290; Pinzon and Cabral (Brazil) B-227; Juan de Solis and Cabot (Argentina) A-281; Magellan M-28.

B. Conquest and Settlement: S-208*l*. Caribbean Coast C-306, G-183, R-49; Central Andes and Pacific Coast P-227*a*, P-140, E-155, C-208, D-90; Plata Region P-67; Portuguese in Brazil B-228; P-314.

C. Successful Revolt of Colonies 1810–25: B-167–8, S-208*l*–S-209, L-67*h*. Guianas Alone Now under European Control G-183, A-146.

XII. COUNTRIES OF SOUTH AMERICA:

A. Colombia: C-305.
- a. Products and Resources: C-306, C-296–8.
- b. Chief Cities: C-305–6. Bogotá (capital), Barranquilla, Cartagena (Fact-Index).

B. Venezuela: V-274.
- a. Products and Resources: V-276, P-151.
- b. Chief Cities: V-275. Carácas (capital), Valencia, Maracaibo (Fact-Index).

C. Brazil: B-225.
- a. Products and Resources: B-226–226*d*, C-294–8, D-59, R-164–6.
- b. Chief Cities: B-227. Rio de Janeiro (capital) R-108; São Paulo, São Salvador, Pernambuco, Pará, Porto Alegre, Manáos (Fact-Index).

D. Ecuador: E-154, P-140 map.
- a. Products and Resources: E-155.
- b. Chief Cities: E-154. Guayaquil, Quito (capital) (Fact-Index).

E. Peru: P-137.
- a. Products and Resources: P-138, P-140.
- b. Chief Cities: P-140. Lima (capital) L-137; Callao (Fact-Index).

F. Bolivia: B-168, S-208*b*–*c* map, B-226 map.
- a. Products and Resources: B-169–70, T-98.
- b. Chief Cities: B-169. La Paz (seat of government), Cochabamba, Sucre (nominal capital) (Fact-Index).

G. Chile: C-205.
- a. Products and Resources: C-207, C-207*a*–*c*, N-148 picture.
- b. Chief Cities: C-207*c*. Santiago (capital) S-26, E-207*a* picture; Valparaiso V-269, S-205 picture; Concepción, Antofagasta (Fact-Index).

H. Paraguay: P-66, S-208*b*–*c* map, B-226 map.
- a. Products and Resources: P-67.
- b. Chief Cities: P-67. Asunción (capital), Villarrica (Fact-Index).

I. Argentina: A-278.
- a. Products and Resources: A-280–280*c*.
- b. Chief Cities: A-280*b*. Buenos Aires (capital) B-259, A-280c picture; Rosario, Córdoba, La Plata, Tucumán, Santa Fe, Mendoza (Fact-Index).

J. Uruguay: U-261.
- a. Products and Resources: U-262.
- b. Chief Cities: Montevideo (capital) M-248; Salto (Fact-Index).

K. Guiana (British, French, Dutch): G-182–3, S-208*b*–*c* map, B-226 map.

Bibliography for South America

—**Books for Younger Readers:**

Allen, N. B. South America (Ginn, 1934).
Carpenter, F. G. South America (Amer. Book Co., 1930).
Eells, Mrs. E. S. South America's Story (Dodd, 1931).
Lansing, M. F. Liberators and Heroes of South America (Page, 1940).
Lhevinne, Isadore. Enchanted Jungle (Coward, 1933).
Marschall, Phyllis and Crane, John. The Dauntless Liberator: Simón Bolívar (Century, 1933).
Rothery, A. E. South American Roundabout (Dodd, 1940).
Sanchez, Mrs. N. V. Stories of the Latin American States (Crowell, 1934).
Tschiffely, A. F. Tschiffely's Ride (Simon & Schuster, 1933).
Von Hagen, V. W. Riches of South America (Heath, 1941).

Stories

Brown, Rose. Two Children of Brazil (Lippincott, 1940).
Desmond, A. C. Soldier of the Sun (Dodd, 1939).
Ditmars, R. L. Forest of Adventure (Macmillan, 1933).
Duarte, M. E. B. The Legend of the Palm Tree (Grosset, 1940).
Fernald, H. C. and Slocombe, E. M. Scarlet Fringe (Longmans, 1931).
Finger, C. J. Give a Man a Horse (Winston, 1938).
Finger, C. J. Tales from Silver Lands (Doubleday, 1924).
Gill, Richard. Manga, an Amazon Jungle Indian (Stokes, 1937).
Gill, Richard and Hoke, Helen. Paco Goes to the Fair (Holt, 1940).
Hudson, W. H. Tales of the Pampas (Knopf, 1939).
Kendall, Oswald. Voyage of the Martin Connor (Houghton, 1931).
Kummer, F. A. Courage over the Andes (Winston, 1940).
Lathrop, D. P. Presents for Lupe (Macmillan, 1940).
Malkus, Mrs. A. S. Silver Llama (Winston, 1939).
Miller, L. E. Hidden People (Scribner, 1920).
Quiroga, Horacio. South American Jungle Tales (Dodd, 1940).
Steen, E. K. Red Jungle Boy (Harcourt, 1937).
Tee-Van, Mrs. H. D. Red Howling Monkey (Macmillan, 1926).
Thomas, Mrs. M. L. Paulo in the Chilean Desert (Bobbs, 1934).
Williamson, T. R. Last of the Gauchos (Bobbs, 1937).

—**Books for Advanced Students and Teachers:**

History, Economics, Geography

Aikman, Duncan. The All-American Front (Doubleday, 1940).
Chapman, C. E. Colonial Hispanic America (Macmillan, 1933).
Chapman, C. E. Republican Hispanic America (Macmillan, 1937).
Duggan, S. P. H. Two Americas; an Interpretation (Scribner, 1934).
Gibbons, H. A. New Map of South America (Appleton-Century, 1928).
Haring, C. H. South American Progress (Harvard Univ. Press, 1934).
Herring, Hubert. Good Neighbors (Yale Univ. Press, 1941).
Kirkpatrick, F. A. History of the Argentine Republic (Macmillan, 1931).
Kirkpatrick, F. A. Spanish Conquistadores (Macmillan, 1934).
Means, P. A. Ancient Civilizations of the Andes (Scribner, 1931).
Riesenberg, Felix. Cape Horn (Dodd, 1939).
Rippy, J. F. Historical Evolution of Hispanic America (Crofts, 1940).
Royal Institute of International Affairs. The Republics of South America (Oxford, 1937).
Shepherd, W. R. Hispanic Nations of the New World (Chronicles of America Series) (Yale Univ. Press, 1918–21).
South American Handbook (H. W. Wilson, published annually).
Tomlinson, Edward. New Roads to Riches in the Other Americas (Scribner, 1939).
Webster, Hutton. History of Latin America (Heath, 1936).
Wertenbaker, Charles. A Doctrine for the Americas (Viking, 1941).
Whitbeck, R. H. and others. Economic Geography of South America (McGraw, 1940).

Travel

Beebe, William. Galapagos, World's End (Putnam, 1924).
Beebe, William. Jungle Peace (Holt, 1918).
Clark, S. A. West Coast of South America (Prentice-Hall, 1941).
Cutright, P. R. Great Naturalists Explore South America (Macmillan, 1940).
Duguid, Julian. Green Hell (Appleton-Century, 1931).
Fergusson, Erna. Venezuela (Knopf, 1939).
Fleming, Peter. Brazilian Adventure (Scribner, 1933).
Forbes, Mrs. R. T. Eight Republics in Search of a Future (Stokes, 1933).
Freeman, L. R. Discovering South America (Dodd, 1937).
Green, P. L. Our Latin American Neighbors (Hastings, 1941).
Hager, A. R. Wings over the Americas (Macmillan, 1940).
Hanson, E. P. Chile; Land of Progress (Reynal, 1941).
Hanson, E. P. Journey to Manáos (Reynal, 1938).
Kelsey, Vera. Seven Keys to Brazil (Funk, 1940).
MacDonald, Norman. Orchid Hunters (Farrar, 1939).
McGovern, W. M. Jungle Paths and Inca Ruins (Century, 1927).
Matschat, Mrs. C. H. Seven Grass Huts (Farrar, 1939).
Mielche, Hakon. Journey to the World's End (Doubleday, 1941).
Peck, A. M. Roundabout South America (Harper, 1940).
Romoli, Kathleen. Colombia (Doubleday, 1941).
Roosevelt, Theodore. Through the Brazilian Wilderness (Scribner, 1914).
Strode, Hudson. South by Thunderbird (Random House, 1937).
Thompson, R. W. Land of To-morrow (Appleton-Century, 1937).
Tschiffely, A. F. This Way Southward (Norton, 1940).
Von Hagen, V. W. Ecuador, the Unknown (Oxford, 1940).
Weddell, A. W. Introduction to Argentina (Greystone, 1939).
Ybarra, T. R. America Faces South (Dodd, 1939).
Young, Ernest. South American Excursion (Longmans, 1940).

Fiction and Biography

Clinton, D. J. Man of Glory: Simón Bolívar (Morrow, 1939).
Clinton, D. J. Gomez, Tyrant of the Andes (Morrow, 1936).
Güiraldes, Ricardo. Don Segundo Sombra (Farrar, 1935).
Hudson, W. H. Far Away and Long Ago (Dutton, 1924).
Hudson, W. H. Green Mansions (Knopf, 1925).
Hudson, W. H. The Purple Land (Dutton, 1916).
White, E. L. El Supremo (Dutton, 1916).
Wilder, T. N. Bridge of San Luis Rey (Boni, 1927).

(*See also* bibliography for **Latin America.**)

SOUTHAMPTON, ENGLAND. At the head of Southampton Water, one of the finest natural harbors of England, with the Isle of Wight standing guard at its entrance to the English Channel, the city of Southampton is primarily concerned with the trade of the British Empire. From its 300 acres of docks much of Great Britain's import trade travels by railway 70 miles northeast to London; and exports of cotton, linen, woolen, worsted, and leather goods, machinery, and hardware start on their long journey to the West Indies and the Pacific (via Panama), to Brazil, to South Africa, to New York, to Cherbourg and Havre across the Channel to the south, and to Dublin, Belfast, and Glasgow. It is also an important port for passenger steamers.

The city lies between the rivers Itchen and Test much as if it were on a peninsula. In ancient days there was a Roman walled town on the east bank of the Itchen, but probably about the 11th century, at the time of the Danish invasions, the present site on the west bank became the important part of the community. From the earliest times its strategic position, both for trade and for military operations, has given it importance, and ruins of the old Roman and Saxon fortifications may still be seen.

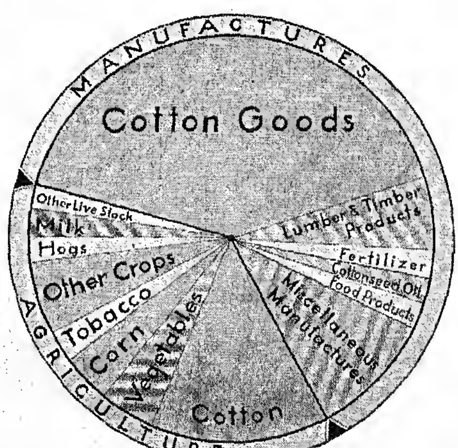
In modern times the growth of ocean-borne trade made Southampton a natural center of commerce. Its harbor has the unusual advantage of a double tide, which comes in through two inlets behind the Isle of Wight with two hours' difference in time. The city has one of the world's largest dry docks and great ship-building and engineering industries. As an important terminus of England's "lifeline" of supplies from abroad, it was bombed repeatedly by the German air force during the second World War and was heavily damaged.

At the harbor mouth is the Isle of Wight. The island's mild climate and beauty make it a favorite summer and winter resort (*see* Wight, Isle of). Population of Southampton, about 175,000.

The PALMETTO STATE—"*Keystone*" *of the* SOUTH

Extent.—North to south, greatest distance, 215 miles; east to west, 285 miles. *Area, 31,055 square miles, of which 461 square miles* are water. Population (1940 census), 1,899,804.
Natural Features.—Over 200 miles of Atlantic coast line broken by islands and salt marshes in the southern part; low Coastal Plain rising to the Piedmont region; Blue Ridge in the extreme northwest (Sassafras Mountain, 3,548 feet). Principal rivers: Pee Dee, Little Pee Dee, Santee, Wateree, Congaree, Broad, Saluda, Edisto, and Savannah, the last forming boundary with Georgia. Mean annual temperature, 63°; mean annual precipitation, 48".
Products.—Cotton, corn, oats, tobacco, hay, potatoes, and sweet potatoes, other vegetables and fruits; hogs, poultry, cattle, dairy products; granite, clay; fish; cotton goods, rayon, lumber and timber products, cottonseed products, fertilizer, railroad cars.
Cities.—Charleston (71,275), Columbia (capital, 62,396), Greenville (34,734), and Spartanburg (32,249).

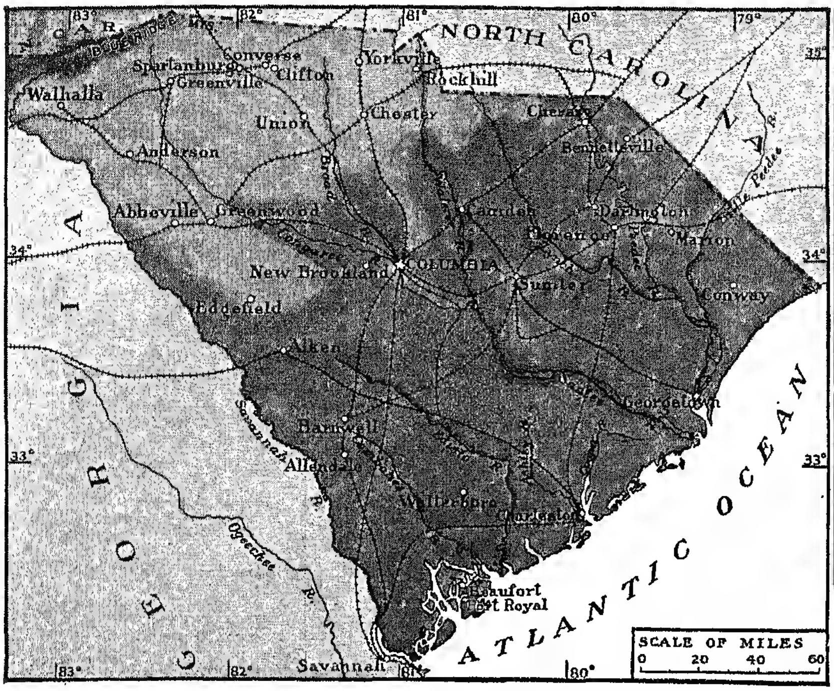
SOUTH CAROLINA. Shaped like a blunt wedge, with its base lapped by the Atlantic Ocean and its point thrust into the Appalachian Mountains, South Carolina has been called the "keystone" of the South Atlantic seaboard. And it is that in more than one sense; for when it broke loose from the Union, in 1860, the whole nation tottered and seemed for a while to be near disaster. Devastated by Sherman's march northward from Georgia in 1865, and forced after the war to face entirely new social and economic conditions, it was many years before the state regained the prosperity which its great cotton and rice plantations had given it under slavery. But with a matchless climate and a soil that will produce almost all the crops common to the different portions of the United States, the "Palmetto State" has advanced steadily in the new era. It ranks among the chief cotton-growing states, and its tremendous water-power resources have been used to build up a great hydroelectric industry which has been a leading factor in the state's rapid manufacturing development, especially in cotton goods. Within a few years South Carolina leaped to a high place among the states in cotton textile manufactures, now being surpassed only by North Carolina in the value of its production.

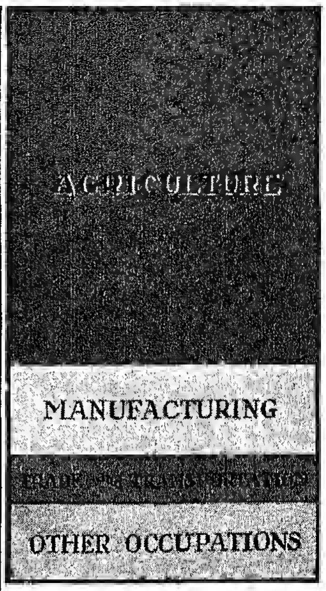


You can see from a glance at this products chart how cotton and cotton manufactures predominate among the sources of South Carolina's wealth.

Few states afford a more interesting study in physiography than South Carolina. From marshy coastal lowlands, fertile interior alluvial plains, sandy highlands, rolling hills and low mountains, the land rises in a series of gradations from the Atlantic Ocean to the southern spurs of the Appalachians. The eastern two-thirds of the state is called "low country," or the coastal plain. The west is the "up-country," or piedmont plateau, the most thickly populated region. This region is supreme in both manufacturing and agriculture, having abundant water power and rich well-watered soils. Dividing these two great sections is the "fall line," which was the old shore of the State when the piedmont plateau was the only part of the Atlantic coast above water. The many rapids on this line are the source of water power. A great dam has been built on the Saluda River near Columbia with a power plant designed ultimately to furnish 300,000 horsepower. The third section of the state is the Appalachian

THE SURFACE OF SOUTH CAROLINA AND ITS LEADING OCCUPATIONS



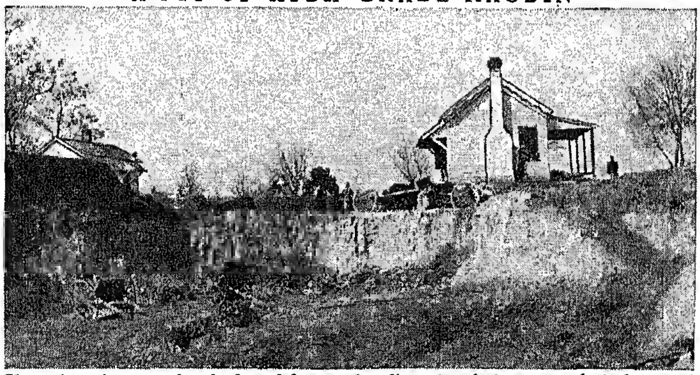


Below a line called the "fall line," running from Cheraw through Columbia and Aiken, the state lies in the Coastal Plain; above the line it lies in the Piedmont Belt.

range, in the extreme northwest, where is found the highest point in the state, Sassafras Mountain (3,548 feet).

"Cotton is king" in a double sense today in South Carolina, and cottonseed is "crown prince." The products of the cotton plant are predominant not only in agriculture but in manufacturing and commerce as well. Cotton is produced in every part of the state, from coast to mountains, and the famous Sea Islands used to produce the finest fiber in the world, before the boll weevil stopped the growing of this long staple variety, about 1920. The arrival of this pest was, however, a blessing in disguise, for it taught the people of the state the advantages of diversified farming, and other crops are receiving more attention every year, until they now have more than twice the acreage and value of cotton. Millions of dollars' worth of garden truck is produced annually to be sent to the great northern cities, including cabbages from the largest cabbage farm in the world, potatoes, and other vegetables. Oats and hay are also raised, instead of being bought from other states, and tobacco is an important crop. Stock-raising and dairying thrive, and are steadily increasing. In the growing of rice, however, South Carolina no longer bears the palm. Because of the difficulty of using modern machinery on its undrained lowlands, Louisiana, Texas, and several other states greatly surpass the state which introduced the industry into America.

A PIT OF HIGH-GRADE KAOLIN



Clay of various grades is found in nearly all parts of the state, but the most important are the deposits of kaolin, which is used in the manufacture of pottery. Kaolin deposits are worked like ordinary clay pits.

Cotton goods and cottonseed oil and cake constitute almost 70 per cent of the total value of South Carolina's manufactured products. The development of the cotton industry has been remarkably rapid. Cotton mills utilizing much of the water power have sprung up one after another all over the piedmont section of the state, giving rise to new towns and bringing prosperity to old ones. Even more rapid has been the development of rayon manufacturing, now the second most important industry. Following textiles in value are the manufactures that depend on the state's forests—lumber and timber, veneers, furniture, and paper. Southern pine (estimated at 3,000 million feet) abounds in the

coastal region, cypress is found in the swamps, and hardwoods on the hillsides in the piedmont section. Coast fishing is of some importance—thousands of bushels of oysters, shrimps, and crabs are canned annually.

South Carolina was for long the country's chief source of phosphate rock, until the discovery of higher grade deposits in other states. Granite is now one of the two leading mineral products. Large quantities are quarried every year for building and monumental work. Clays for brick and tile are found in practically all sections and there are extensive deposits of high-grade kaolin, which is shipped to other states for use in making pottery.

The largest city and most important seaport and commercial center in South Carolina is Charleston (*see* Charleston). In the center of the state is Columbia, the capital, which was destroyed by a fire in the Civil War but is now one of the handsomest cities of its size in the country. Picturesquely situated on the level top of a bluff, it overlooks the Congaree River, which, plunging down in many rapids, affords abundant electricity for the city's use. Cotton manufacturing is the most important industry, but there are also glass works, granite quarries, and a large lumber industry. There are many educational institutions, of which the University of South Carolina is the most important; and a State House which is one of the most imposing in the country.

Greenville and Spartanburg, at the foot of the Blue Ridge Mountains, are other thriving cotton-manufacturing centers, situated in some of the finest cotton country and general farming lands of the state. There are also iron works and various other manufactures in this region.

Early Government Was of Feudal Type

The first settlement attempted in South Carolina was made in 1562 by a body of French Protestants, who named the place at which they landed Port Royal, "because of the fairness and largeness thereof." This colony was, however, shortly abandoned. In 1663 Charles II of England made over to eight of his lords and gentlemen the provinces of "Carolina," which two years later was defined to include the whole of the present Carolinas, Georgia, and much of Florida, and extended east and west "from sea to sea." Among these "proprietaries" were the Earl of Clarendon and Sir Anthony Ashley Cooper (later made Earl of Shaftesbury), from whom the Ashley and Cooper rivers were named. In 1669 this proprietary board adopted for the colony an elaborate system of government, based on feudal principles and drawn up by the philosopher John Locke. Though greatly modified in actual operation, this constitution encouraged the plantation system and a slaveholding aristocracy.

THE STATE CAPITOL AT COLUMBIA

Light-grey granite walls, handsome porticoes, and the comparatively small green dome in the style of the Italian Renaissance give the state house an air of unusual grace. Begun in 1851, it was not used until 1869.

The first permanent English settlement, established in 1670 on the west bank of the Ashley River, was named Charles Town, in honor of Charles II. In 1680 it was moved to the east bank between the Ashley and Cooper rivers. After the Revolution its name was officially changed to Charleston.

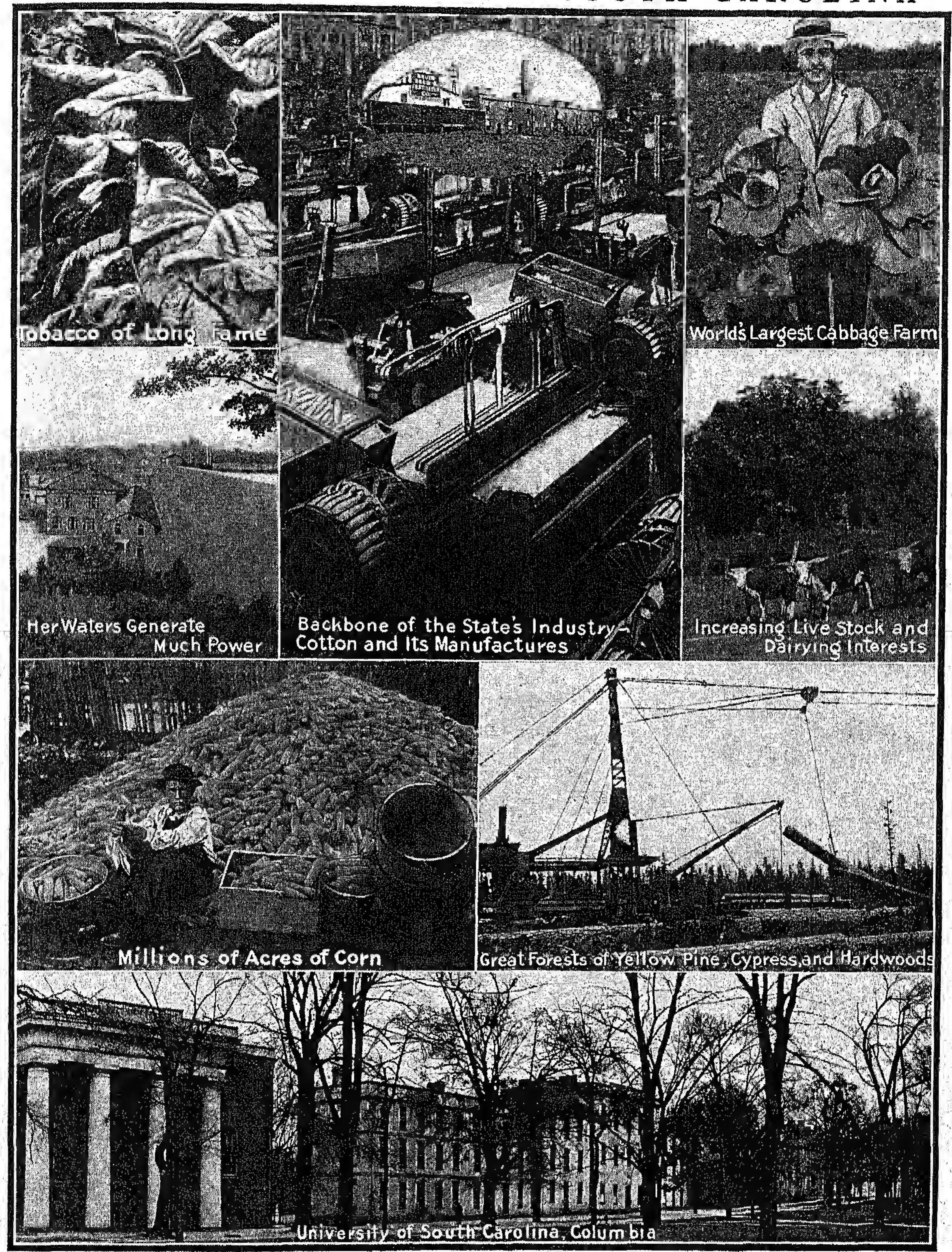
The colony prospered, first through trading with the Indians and shipping—principally furs and skins to England and grain to the West Indies—and later from the vast crops of rice and indigo that grew on the wide plantations lining the rich river valleys of the "low country."

Battles Between English and Spanish

The Spaniards in Florida, who had held a fort on Parris Island from 1566 to 1587, incited the neighboring Indians to war on the English colonists in 1671–72. Lord Cardross, a nobleman in search of religious freedom, established a Scottish settlement, Stuart Town, at Port Royal in 1684. Spaniards from St. Augustine descended suddenly upon Stuart Town in 1686, killed many of the Scottish settlers, and burned near-by plantations owned by English colonists. South Carolina colonists sought revenge by attacking St. Augustine in 1702, but were beaten back. In 1706 a French fleet arrived and demanded Charles Town's surrender, but Col. William Rhett armed some merchant vessels and drove it away. In 1718 Rhett vanquished the pirate fleets that menaced Carolina shipping.

Clashes with the proprietors and their governors were numerous. The colonists refused to help fight the Yamasee Indians in 1715, and revolted and named

TOKENS OF WEALTH IN SOUTH CAROLINA



Tobacco of Long Fame

Backbone of the State's Industry—Cotton and Its Manufactures

World's Largest Cabbage Farm

Her Waters Generate Much Power

Increasing Live Stock and Dairying Interests

Millions of Acres of Corn

Great Forests of Yellow Pine, Cypress, and Hardwoods

University of South Carolina, Columbia

In these pictures of South Carolina's leading products and industries, we see how handsomely Nature has favored the state. From the rich fields, South Carolina obtains a long and varied list of products, of which tobacco, corn, and cabbages are conspicuous examples. The forests yield a wealth of timber, and the harnessed streams give power that is used in the cotton mills and elsewhere. The excellent university at Columbia is one of the many institutions supported by the state's prosperity.

James Moore governor. In 1719 they persuaded King George I to make South Carolina a royal province.

Under the crown the colony grew in prosperity and population. Owners of the plantations built magnificent country estates, with luxurious homes and gardens of rare beauty, many of which still lend charm to the "low country." A cultured society developed, and Charles Town became the center of gaiety and fashion and interest in the fine arts, especially in drama and music. Fine libraries, schools, and theaters were established. The hardy folk in the "up country"—land-hungry settlers from other colonies, and German, Scotch-Irish, French Huguenot, and Swiss immigrants—raised rude log cabins, tended their herds, and tilled small farms.

Heroes of Continental Days

Among the men who represented South Carolina in the Continental Congress and left their mark on the state and the nation were Edward Rutledge, Thomas Lynch, Jr., Arthur Middleton, and Thomas Heyward, Jr., signers of the Declaration of Independence. The first state constitution, drafted in March 1776, was temporary, pending settlement of the differences with England; but the second, adopted in 1778, declared the state independent of England, with a senate elected by the people. Col. William Moultrie and his command of militia in a fort of palmetto logs on Sullivan's Island repulsed the British fleet that brought Sir Henry Clinton's army to attack Charles Town in May 1776.

When Clinton returned in 1780, he found the state with little defense because its sons were fighting on other fronts. Col. John Laurens and Col. Charles Cotesworth Pinckney, serving as aides to General Washington, hurried back, and Count Pulaski, the brave Polish leader, brought south a small force. However, Charles Town fell, and the British gained control of the whole state.

Greene and the Mountaineers Defeat Cornwallis

For a time the patriot cause seemed lost, then three great leaders, Gen. Francis Marion, Gen. Andrew Pickens, and Gen. Thomas Sumter, drew about them groups made up chiefly of woodsmen from the "up country" and captives escaped from parole. They were called Partisans, and fought bitterly to free the state. Congress sent Gen. Horatio Gates (*see* Gates, Horatio) and 1,400 troops to help, but they were defeated by Cornwallis at Camden. Then Gen. Nathanael Greene was put in command, and mountaineers from the whole Carolina and Virginia frontier joined in the great victory over the British at King's Mountain. One of the posts from which the British were driven was the splendid plantation home of Mrs. Rebecca Motte on the Congaree River. When the Partisans told Mrs. Motte that they would have to burn the house to drive the enemy away, she handed them a bundle of fire-arrows to kindle the flame.

Prosperity returned early to this war-torn state. The cotton gin had been invented, and the "up country" people grew wealthy by raising cotton. The Santee Canal, many highways, and the first railroad (1833) were built to move the cotton crops.

After the piedmont folk protested that the planters in the "low country" were controlling the government, the capital was moved from Charleston (as it was now called) to Columbia during the term of Governor Moultrie (1785–87). Representation in the legislature was changed to give the upland dwellers control in the senate.

South Carolina in the Civil War

In national affairs, two South Carolinians, John C. Calhoun and Robert Y. Hayne, led the faction that demanded states' rights, and fought also against high tariffs framed to protect northern industries (*see* Calhoun, John Caldwell). South Carolina declared the tariff laws of 1828 and 1832 null and threatened to secede from the Union if force was used to enforce them (*see* Jackson, Andrew). The state did secede in December 1860, after Abraham Lincoln had been elected president, because the people thought he would free the negro slaves whose labor in the cotton and rice fields meant Carolina's prosperity. (*See* Civil War.) South Carolina troops opened the war by firing on Fort Sumter, held by a Federal force. A power in the Confederacy, the state gave freely of men and money during the long years of war. Its capital was burned and many miles of countryside laid waste during Sherman's march to the sea in 1865 (*see* Sherman).

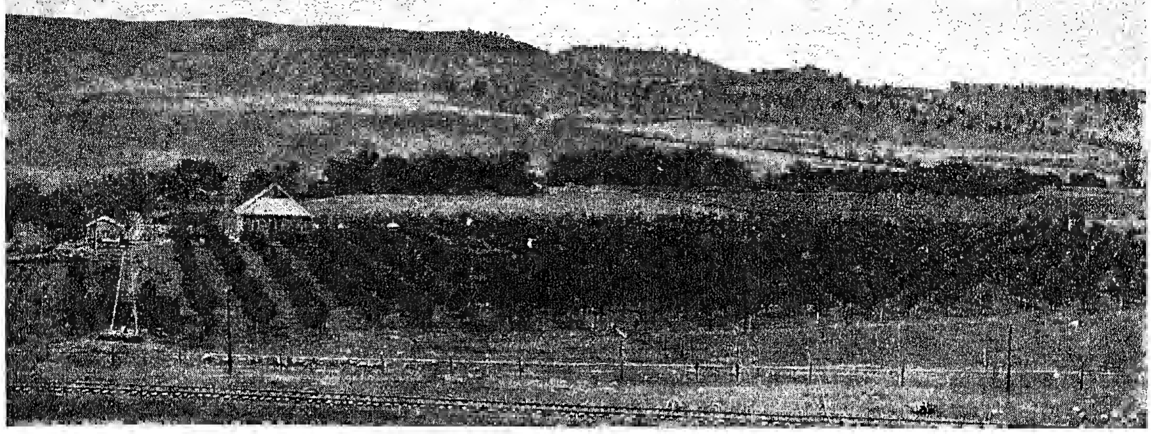
The years of Reconstruction were as bitter as those of war, with "carpetbaggers"—politicians from the northern states—and newly enfranchised negroes in power. But in 1876, the white Democrats gained control, and placed Gen. Wade Hampton in the governor's chair. In 1895, after the Farmers' Movement, which sought reforms favoring the upland farmers, had swept Gov. Benjamin R. Tillman into office, a new constitution set up property and literacy qualifications for voting. South Carolina is the only state whose constitution forbids divorce.

The State's Recent Progress

Despite a disastrous earthquake in 1886 and a storm which cost more than 1,000 lives in 1893, South Carolina has developed steadily since Reconstruction days. Besides its industrial and agricultural growth and improvement, its balmy climate and varied scenery draw many winter visitors to fashionable Aiken and other picturesque and historic spots.

The schools have been improved as its educators have sought to lower the high illiteracy rating, caused by the large negro population. Its institutions of higher education include many denominational and private colleges: the College of Charleston, founded in 1790 at Charleston; the University of South Carolina, at Columbia, 1805; the Medical College of the State of South Carolina, and The Citadel, a military college, both at Charleston. Clemson Agricultural College was established on the John C. Calhoun estate in 1889. Winthrop College at Rock Hill is for women. State Colored Normal, Industrial, Agricultural, and Mechanical College is at Orangeburg.

ON SOUTH DAKOTA'S ROLLING PRAIRIES



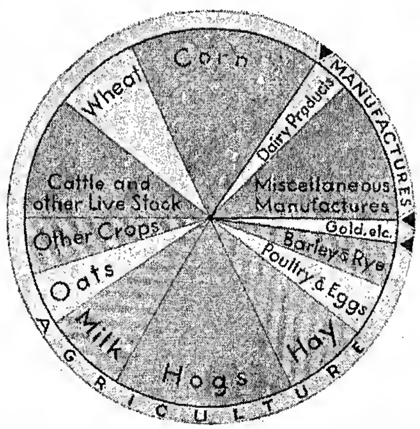
Extent.—East to west, 380 miles; north to south, 225 miles. Area, 77,047 square miles. Population (1940 census), 642,961.

Natural Features.—Rolling plains broken by the Bad Lands of the White River and the Black Hills in the southwest (highest point, Harney Peak, 7,242 feet). Rivers: Missouri and its tributaries, the Big Sioux, James, Grand, Moreau, Cheyenne, and White. Mean annual temperature, 45°; mean annual precipitation, 20″.

Products.—Corn, wheat, hay, oats, barley, potatoes, flaxseed, rye; hogs, cattle, dairy products, poultry, sheep, wool, horses; gold, tungsten, tin, mica, stone; flour, meal, and other food products.

Cities.—Sioux Falls (40,832); Aberdeen, Rapid City, Huron, Mitchell, Watertown (over 10,000); Pierre (capital, 4,322).

SOUTH DAKOTA. Save for an uplifted area nearly as large as New Jersey in the southwest corner of the state, South Dakota is a vast rolling plain, a part of the great Mississippi valley which stretches in unparalleled richness from the Alleghenies and the Great Lakes to the Rocky Mountains. It is divided into two fairly equal parts by the great Missouri River, yellow with silt, which traverses the state from the center of the northern boundary just below the 46th parallel to the Nebraska line, where it veers to the southeast to form part of the state's southern boundary. The pioneer always described his location as east or west of "the river." And not all its railways and motor cars, nor yet rural free delivery, will ever do away with this distinction. For the two halves of the state are very different—topographically, in their history, and in their growth.



A large part of South Dakota's wealth comes from its farms and ranches, as this chart shows.

"East of the river" is rich prairie land, like Iowa and Illinois. Its drainage is from north to south, in the valleys of the James and the Big Sioux, which flow into the rapid Missouri. With practically the normal rainfall of the Mississippi valley it is a land of prosperous farms, at almost "Iowa prices" per acre. Most of South Dakota's cities having a population exceeding 3,000 are located in this region.

The "west of the river" country is part of the Great Plains—vast level stretches broken by occasional clusters of low hills and cut into deep ravines by every stream, big and little; treeless save for clumps of oak, elm, and cottonwood along its scattered waterways. Much of it is open country, a land of great ranches feeding cattle and sheep by the thousands. Farming, particularly sugar-beet raising, was promoted in the northwest by the building of the Belle Fourche Dam, an irrigation project of the Bureau of Reclamation, which waters 100,000 acres of once semi-arid land.

The Black Hills in the southwest are densely forested over all but the eastern edge and produce four-fifths of the state's timber. Mt. Harney is the highest peak east of the Rockies. The charm of the jagged ridges and canyons, rapid streams, sparkling waterfalls, and odd rock formations, such as "The Needles," lures thousands of visitors over the scenic highways. Many beauty spots and hundreds of acres of forests have been preserved by the state and national governments.

Mount Rushmore's rocky eminence in Custer State Park, over 6,000 feet above sea level, is a monument to the builders of the United States. Carved in the granite face of the cliff, massive busts of Washington, Jefferson, Lincoln, and Theodore Roosevelt gaze serenely out over mountain and valley. The sculptor Gutzon Borglum began work in 1927. After his death in 1941, the task was carried on by his son Lincoln Borglum. The figures are carved to the proportion of men 465 feet tall.

Farming is carried on wherever rainfall is sufficient. Game and fish are plentiful. Cold springs abound. Hot springs are numerous in the south-

ONCE FAMOUS FOR "BAD LANDS," NOW FOR GOLD AND GRAIN

The map shows clearly how the Missouri River divides the state into two parts of almost equal area. West of the river the drainage is eastward; east of it, southward. At the right you see the relative number of persons in various occupations.

western corner, where the Federal government has set aside about 20 square miles as the Wind Cave National Park. The great cavern which gives its name to the park contains many miles of galleries, once the channel of subterranean streams. In one corner of the park is a game preserve with herds of bison, elk, and antelopes. (*See* National Parks.)

Between the Hills and the White River lie the famous "Bad Lands." Here Nature, by the erosion of a stratified sandstone plain, has built a strange labyrinth of tall columns and pinnacles, bare toadstool-like tables bearing no vegetation except buffalo grass or "blue stem," contrasting vividly in color with the soft grays, creams, and rose of the supporting clay. This weird formation follows the north side of the White River for 120 miles, varying in breadth from 30 to 50 miles.

The climate of South Dakota, so far from both oceans, is continental in character and subject to great extremes of heat and cold. In the Black Hills, which give shelter from the prevailing northwest winds and storms, a milder condition prevails.

Pierre, the capital, is almost exactly in the center of the state, on the Missouri River. Attracted by the reports of the Lewis and Clark expedition of 1804–06, the American Fur Company established a trading post at Pierre in 1832. But growth has been slow, and despite its state house and other public businesses, its natural gas and thriving cattle market, Pierre still has only a few thousand people. Yankton and several near-by settlements made a start in the 1850's but their development too was retarded, first by the Civil War, and then by Indian uprisings led by Spotted Tail, Red Cloud, and Sitting Bull, throughout the period 1863–76.

The great Sioux reservation in the center of the state—then a little larger than the state of Maine—long blocked the way for men from eastern settlements who had visions of the wealth to be gained in this fine cattle country. It seemed necessary to break up the reservation, and the white man has snipped and snipped—11,000,000 acres once, smaller tracts from time to time—until now only a few hundred square miles, held in eight scattered reservations, remain to the Indians. The chief of these is the Pine Ridge reservation, on the southwestern border of the state, where Sitting Bull and his Sioux were placed after their last bloody outbreak in 1876. In all some 29,000 Indians, mainly Sioux (or Dakotas), now inhabit the state.

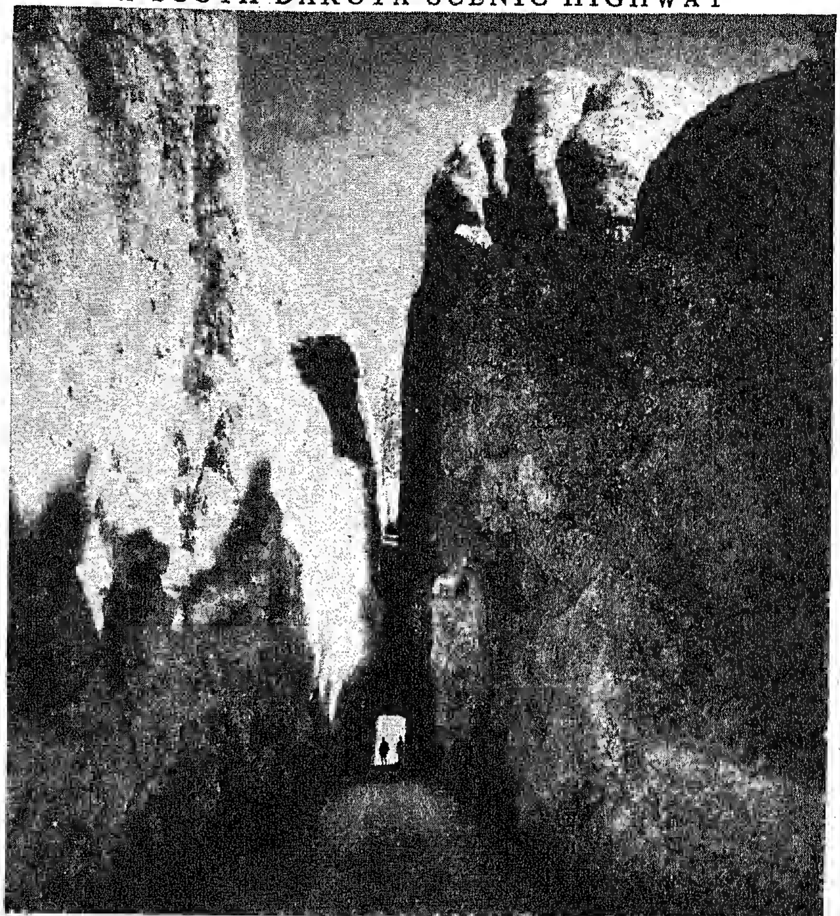
In 1874 a surveying party for the Northern Pacific Railway went into the Black Hills under the protection of Gen. George A. Custer of the United States Army. Miners at that time discovered gold at French Creek, in the south part of the Hills, and later in the district now made famous by the great Homestake Mine, at Lead. The Indian cession of their right to the Black Hills country, in 1876, was splashed with crimson in the historic massacre of Custer and his men in the Little Big Horn country in nearby Montana. (*See* Indians, American; Montana.)

For ten years after the discovery of gold, little headway was made in developing the mines. Then the Chicago & Northwestern Railway extended its line north as far as Buffalo Gap. Here began the stageline which carried mail, provisions, and eager prospectors to each new strike. Deadwood was a famous mining town, with such picturesque figures as Wild Bill Hickock and Calamity Jane, and the fabled Deadwood Dick, hero of dime novels.

The Homestake Mine is still perhaps the largest and most easily worked mass of low-grade ore in the world. The ore has only to be crushed, and its "free gold" is easily extracted by the cyanide process, several hundred tons being put through daily. Gold is found in small quantities elsewhere in the Hills, and also extensive deposits of mica, gypsum, and lignite (low-grade coal). Silver, copper, and lead, feldspar and graphite are found, and such rare minerals as tungsten, lithium, tantalum, cesium, and beryllium. Oil and gas also have been discovered.

Though minerals bring wealth to South Dakota, the products of the fertile farms exceed the mineral output in value by several million dollars annually. The state ranks high as a producer of corn, hay, hard spring wheat, oats, barley, and flaxseed. The quality of the great live stock herds is constantly being improved. Dairying is increasingly profitable.

A SOUTH DAKOTA SCENIC HIGHWAY

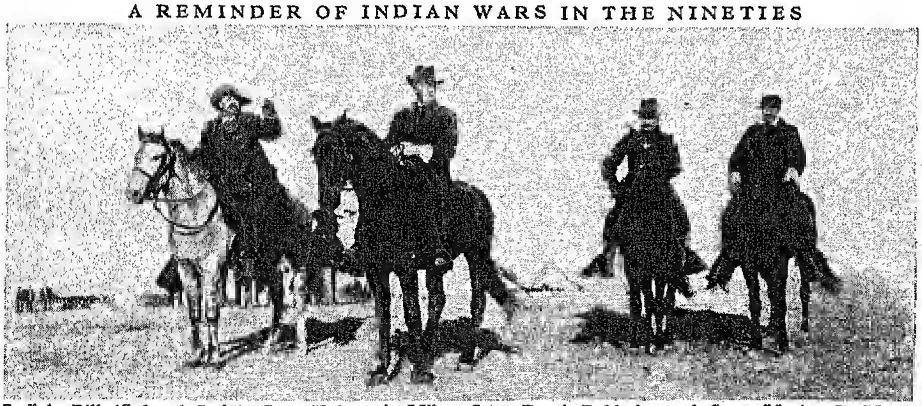


Right through the "eye" of the Needles, the state of South Dakota has tunneled a wide highway, so thousands of touring visitors may view the curious rock formations in Custer State Park, located in the Black Hills.

With a population more than 80 per cent rural, only six South Dakota communities have more than 10,000 inhabitants—Sioux Falls, Aberdeen, Huron, Mitchell, Rapid City, and Watertown. They are trading centers for their country areas, and their chief industries are those that process farm products, especially meat packing and butter making.

Furs first brought industry and commerce to the Dakotas. Most of the early explorers sought to buy furs from the Indian peoples (for territorial history, *see* North Dakota). In 1811, Wilson Price Hunt and his men, moving westward to open John Jacob Astor's great trading post at the mouth of the Columbia River, clashed with Astor's rival, Manuel Lisa, the Spanish trader, as they pushed up the Missouri from St. Louis through the South Dakota country. Lisa's influence with the Indians was so great that he was able to bring the Sioux back home from the

A REMINDER OF INDIAN WARS IN THE NINETIES



Buffalo Bill (Colonel Cody), Gen. Nelson A. Miles, Capt. Frank Baldwin, and Capt. Marion P. Maus, viewing a hostile Indian camp near Pine Ridge, S. D.

siege of Fort Meigs, Ohio, where they were aiding the British in the War of 1812.

WHERE HISTORY HAS BEEN CARVED IN STONE

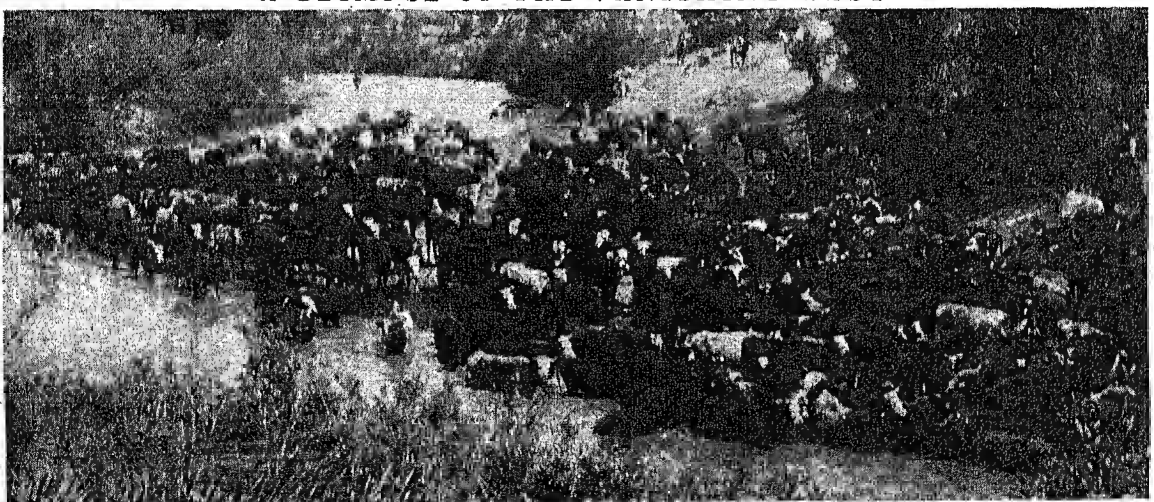
Monument to the building of America, Mount Rushmore National Memorial has been carved out in South Dakota's Black Hills near Rapid City. Giant heads of Washington, Jefferson, Lincoln, and Theodore Roosevelt represent the founding, expansion, preservation, and unification of the nation. The memorial required engineering as well as artistic skill. After the surface rock had been blasted away the figures were cut out of the grayish-white granite by compressed-air drills. Chisel-point drills smoothed off the surfaces, and finally the features were polished. The carvers were guided by scale models. A huge square room, hewn from a canyon directly behind the great heads, will bear inscriptions telling about the memorial. Approached by a stone stairway, this Hall of Records will also have important documents sealed in the walls.

Settlers came but slowly at first into this Indian country. Pioneers answering the call of the rich farm lands entered the country in ox-drawn "prairie schooners," or on river boats, which plied far up the streams to rolling plains and beckoning hills. Hardship was sometimes followed by tragedy when these brave settlers were driven away or massacred by Indians, and their live stock slaughtered and their homes burned. More peaceful times, after the coming of the railway and the discovery of gold in the Black Hills by General Custer brought throngs of settlers during the "Great Dakota Boom" from 1877 to 1883. Yankton, the site of a Yankton Indian village, was established as a permanent trading post in 1858. It was the capital of Dakota Territory until 1883. Scandinavians, Germans, and Russians joined with easterners and helped to open up the territory. Today foreign-born make up only a small proportion of the population, but nearly a third are of foreign-born parentage.

The pioneers took up homesteads or bought farms from the land companies and began building their one-room homes and tilling the soil. Grueling hardships faced them—Indian troubles, six years of grasshopper plague, ending in 1876, the early autumn snows of 1880, the spring floods of 1881, the raging blizzard of 1883, and later searing drouths. Farming methods which had been successful in their foreign homes failed on the prairie. Some gave up the struggle, but most of these hardy folk learned the ways of the new land and slowly built up prosperous farms on the virgin prairies.

Educational and religious advantages for their families were their first ambitions. The government had set aside two sections of each township for a territorial school fund. In 1879 a rumor that speculators were to buy this land cheaply reached Gen. W. H. H. Beadle, territorial superintendent of public instruc-

A GLIMPSE OF THE VANISHING WEST

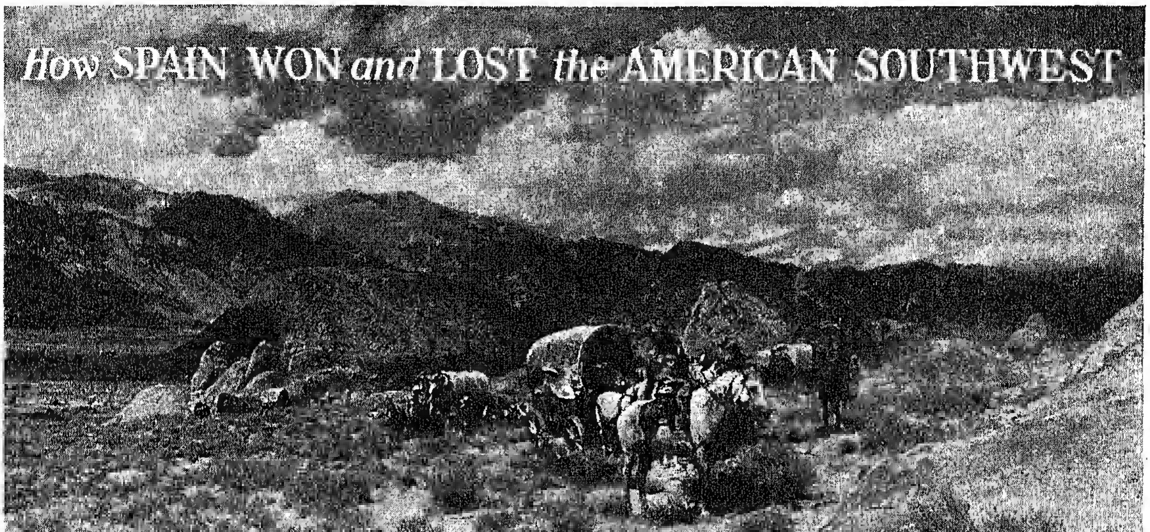


A generation ago herds of cattle everywhere roamed the open range in the western part of South Dakota, but now herds as large as this one, brought to water in the Bad River near Pierre, are not so common. The range has been broken up by settlement, and the homesteader's fence long since restrained the cowboy and his herds.

tion. Public-spirited citizens organized to fight the sacrifice of school lands, and started the movement to divide Dakota territory into two states. During the long struggle for statehood, General Beadle protected the educational interests by making certain that the constitutions adopted in 1883 and 1885 and the final revision in 1889, as well as the act of Congress admitting the state to the Union in 1889, contained a provision whereby no school lands could be sold for less than $10 per acre. Arthur C. Mellette, last territorial governor, was the first state governor.

The Schools of South Dakota

Dr. Joseph Ward, Congregational minister in Yankton, a South Dakota pioneer in higher education, organized Yankton Academy in 1872, and in 1882 he opened Yankton College, of which he was president for many years. The University of South Dakota at Vermillion was founded by the territorial legislature in 1862; it did not open, however, until 1882. South Dakota State College of Agriculture and Mechanic Arts, at Brookings, was opened in 1883, and the State School of Mines, at Rapid City, in 1887. In each quarter of the state there are teacher-training schools—normal schools at Madison, Spearfish, and Springfield, and a teachers college at Aberdeen. Denominational schools include Yankton College at Yankton, Huron College at Huron, Dakota Wesleyan University at Mitchell, and Sioux Falls College and Augustana College at Sioux Falls. The public school system is being constantly extended with money from the permanent fund derived from sale or lease of public lands. Few states have a smaller proportion of illiteracy. South Dakota was the first state to adopt the initiative and the referendum (1898).



Something of the spirit of the great Southwest, its wide expanses of sky, the natural ruggedness of its beauty, and the romantic character of its past, has been captured in this scene from the Universal photoplay, 'Crimson Days'.

SOUTHWEST, AMERICAN. North into California runs *El Camino Real* (the King's Highway), from the great warm harbor at San Diego to the bluff on the peninsula that overlooks the Golden Gate of San Francisco Bay. Threaded along its course, the walls of adobe missions still stand, reminders of the day when there was a "golden age" in California, and when Franciscan friars took their lives in their hands and carried the Gospel to the farthest frontiers of this great stretch of land called New Spain.

In the year in which the Continental Congress in Philadelphia (1776) declared the independence of the colonies from England, the Spanish thrust reached its last outpost in the mission and *presidio* (fort) of San Francisco. No one knew that the empire of Spain was near the end of its greatness, and that in the hall of the State House in Philadelphia was beginning an empire marked by destiny to drive the Spanish south of the Rio Grande and the Sierra Nevada.

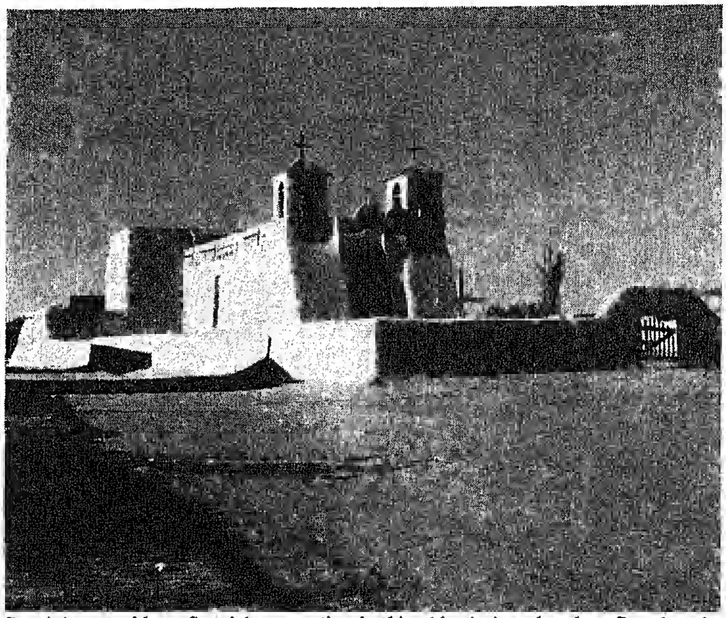
When Antonio de Mendoza came out in 1535 as first viceroy of New Spain, the northern borders of his domain extended to two great deserts. Through one of these the Rio Grande wandered to the Gulf of Mexico; and along the northern and western sides of the other the Colorado cut its way down from the high Rockies to sea level on the Gulf of California. For more than 200 years Spain took little interest in this land to the north, planting a few small villages where there was water and collecting information about the country beyond the border. De Soto, Cabeza de Vaca, Coronado, and Cabrillo, in a few years after the vice-royalty was set up, spied out the land and brought home discouraging reports of its value.

From the wanderings of Cabeza de Vaca along the northern shore of the Gulf of Mexico came rumors told by Indians of cities of gold somewhere in the interior. These could not be verified, yet they kindled the hope of discovering mines like those of Mexico

and Peru. De Soto (1539–42) tramped from Florida to the Mississippi in a vain search for easy wealth. Coronado, from a port on the west coast of Mexico, made a journey (1540–41) around the Sonora Desert and the valley of the Rio Grande, and continued east into central Kansas, with the golden cities always just a day's march ahead. Cabrillo (1542), lured by the tales, sailed northward, found at San Diego a harbor, but never reached the fabled cities. (*See* America.)

In the years that followed the northern frontier was left to casual explorers and indomitable missionaries, while the greater folk of Spain devoted their time and labor to regions where profit was certain to be found. The seemingly endless trail to the northwest began at Vera Cruz and was soon well marked across unhealthful flats and up slopes as far as Mexico City. From the capital city, the trail pushed northward, becoming as it advanced less and less easy for the rough bullock carts that carried freight.

THE SPIRIT OF THE SOUTHWEST



Reminiscent of long Spanish occupation is this old mission church at Ranchos de Taos, New Mexico, located on the "Indian detour," a trail arranged to show tourists leading points of interest.

Half a century after the grand tour of Coronado, a colony was founded in the upper valley of the Rio Grande, at the northern end of the main highway. Here the river, which rises in the Rockies, flows southward between two parallel ranges of mountains, with fertile grassy plains on either side. This is New Mexico. Santa Fe, founded in 1609, where a few ranchers, priests, and soldiers lived, had almost no contact with the outside world, until Zebulon Montgomery Pike wandered along in 1807. In 1821 overland trade with the Missouri border brought the settlements into touch with the United States.

Trails in the Wilderness

East and west from the main road, branches turned off to other outposts. One of them crossed the Rio Grande at the mission of San Juan Bautista, leading to the French station at Natchitoches on the Red River. San Antonio, founded in 1718, became a center for sparse occupation of the plains of eastern Texas. The other branch road swung westward to the valley of the Gila River and the Gulf of California.

While the Texas stations were being planted to the east, Jesuit missionaries were moving westward through Sonora toward Arizona and southern California (*see* Arizona; New Mexico). Father Eusebio Kino was the most notable among these for more than 20 years. Before his death in 1711, a chain of churches reached along the new frontier to the Colorado River. The costs of his expeditions were borne by contributions from the faithful, for Spain was too poor to pay them out of her treasury; and the missions generally had to be self-supporting. No great enterprises were developed to tempt investors, although a few silver mines were opened in Arizona.

The Indians, converted to Christianity, cultivated the fields and tended stock on the ranches, and the missionary fathers taught the tribesmen not only religion but also farming and the needed crafts, such as carpentry and leather-working. Too far away for supplies from Spain, and with no exports, the Spanish missions and ranches, whether in Texas, New Mexico, Sonora, or Lower California, knew only a stagnant, simple life.

Dangers from the North

The Seven Years' War, which is known in America as the French and Indian War, brought England on the scene as a danger to Spanish control in the Southwest. Hitherto the rough settlements of English colonists were generally east of the Appalachians, and between them and the Spanish outposts was Louisiana, the domain of France, from which nothing was greatly to be feared. The most successful of the struggling French colonies were far away in the St. Lawrence Valley. New Orleans, near the Mississippi's mouth, had not prospered. However, the treaty of 1763 changed things. Spain was forced to surrender Florida and received from France the western half of Louisiana, which she did not greatly desire. Far from New Mexico it could not be a source of strength. Spain, nevertheless, held it with some firmness to protect Texas and Mexico from the pressure of the English settlers.

Shortly after 1763, the Spanish king Charles III sent José de Galvez, an energetic and honest agent, to New Spain to reform its government. He organized the northern settlements under the name of Interior

Provinces, strengthened the frontier posts to resist better foreign pressure, and set up a new front line towards the Colorado River to protect Lower California and Sonora. Rumors reached him that dangers might come both from the English on the northeast and from the Russians on the northwest. Russian fur traders, who crossed to North America from Siberia, had reached Alaska, and were pushing down toward San Diego, which the Spanish had not occupied.

Galvez visited Lower California, as the country south of San Diego Bay was called, and then determined to establish a chain of stations in Alta California, the present state of California. He proposed to take the country with a fleet sent north from Mexico, and an army marched overland from Lower California. The Bay of Monterey, which had been discovered by Sebastian Vizcaino on his voyage of exploration (1602–03) he decided to hold for the king of Spain.

In 1769 the work began with the erection of a fort and a mission at San Diego. The greatest of the California missionaries, Father Junipero Serra, devoted his life to the conversion of the Indians and the organization of mission colonies (*see* California). The soldier, Gaspar de Portola, built a fort at San Diego, and then led his men north along the coast. Before the summer ended, he came by chance to an unknown inland sea, later called the Bay of San Francisco. The value of this bay as a harbor and as a strategic point from which to control a large country was clear at once. Here *El Camino Real* ended, though seven years passed before the actual occupation of the presidio of San Francisco took place, since the chain of forts had to be advanced a link at a time from the military base at San Diego.

SPANISH DAYS LIVE AGAIN

This old ox-cart of 150 years ago, used in an Old Spanish Days Fiesta at Santa Barbara, Calif., is typical of the quiet simplicity of life in the "Golden Age" of California.

The Golden Age in California

The Grand Canyon of the Colorado River, now a great national park, was a calamitous obstacle for the Spanish, intent on defending New Spain, because the yawning depths of its great chasm were almost impassable barriers to California by land (*see* Grand Canyon). Within a few years after the building of the missions, the country between Santa Fe and San Francisco was explored in the hope of finding a satisfactory route. In 1774 the Spanish explorer Juan de Bautista de Anza crossed from Sonora by way of the Gila River. Father Francisco Garcés, a Franciscan friar, broke a trail from Santa Fe, which crossed the Colorado at the Needles, a few miles below the point where the boundaries of the present states of Arizona and California meet, and continued west by way of the Mohave Desert. However, these routes were too rough for common travel; indeed, no good way to California was found, and the villages here, like those elsewhere on the northern frontier, were forced to be self-sufficient.

Yet, California, though hard to reach, was a land of happiness. Its gentle climate and fertile soil made life comfortable without much hard work. Adobe churches, from which Spanish influence spread among the Indians, were built to resemble those of Spain—as much as churches of mud could look like those of stone. Within their heavy walls the resemblance was even more marked, for gifts of paintings, silver ornaments, and carved wood decorated altars and walls. Near the churches were the villages of the Indians, for whom conversion meant both harder work and more certain living than they had known.

The building of a presidio alongside a mission, as was often necessary for protection in the early years, brought soldiers, who purchased the produce of Indian farms and hired Indian servants. Most of the soldiers came to California unmarried. When their periods of enlistment ended, many took Indian wives and built homes near the missions. They and their children became farmers and ranchers. Some of them acquired far-reaching estates, where they lived in patriarchal style—in mud houses, to be sure, but with great herds and plenty of the simple things of life. They lacked most of the ordinary manufactured goods, but they had a few luxuries, such as silverware and jewels, and they imported satins and laces from Spain.

Another feature of the Spanish civilization was the *pueblo*, or non-military town, founded by the Spanish. Since the Spanish colonies had none of the easy emigration that filled the English colonies with working settlers, groups of families were sometimes sent to the frontier to found villages, which grew slowly, but steadily. For about 50 years, the new frontier remained outside the currents of active trade and foreign contact. Spain made every effort to keep the colonies in isolation, and only the separation of Mexico from Spain in 1821 broke down the barriers.

"Manifest Destiny"

From the presidio on San Francisco Bay to the fort at Nacogdoches, at the head of the Sabine River, the far-flung northern frontiers of New Spain were in

their "golden age" when Jefferson in 1803 bought Louisiana from France. Then, almost in a moment, the picture changed once more. What Spain could never do, the United States could not prevent. The efforts of missionaries and colonists had hardly scratched the soil. Over all the country between the Mississippi River and the Pacific Ocean, there were only a few scattered homes and towns of white men. "New Spain" was merely a name—a false name, indeed, for "Old Spain" had stayed at home. There was little of that transfer of a civilization, piece by piece, and man by man, which had made New England and Virginia into the domain of sturdy British folk. However, when the call of home-seeking that converted English colonists into Americans lured pioneers to the West, new states ripened down the Ohio Valley and along the Mississippi. Then it was that so-called "manifest destiny" drove the American frontier into victorious clash against the Spanish. (*See* United States History.)

Americans began pouring into the Interior Provinces of Spain in 1820–30. Into Texas came Stephen Austin, leading Mississippi and Tennessee backwoodsmen, not to make war against Mexico, but to seek homes. Others followed, and long before Americans were as numerous as the Mexicans among whom they settled, it was clear that nothing could change their devotion to the Union. Before Jackson left the White House, they had established an independent republic and shortly (1845) entered the Union. (*See* Texas.)

Into New Mexico, after 1821, marched annual processions of Santa Fe traders. Their covered wagons carried stocks of goods that Spanish merchants had never even tried to sell. They had no political purpose, but their coming revealed the fact that the outside world was nearer to New Mexico by way of the Missouri border than by the mule and wagon track that stretched nearly 2,000 miles southward to Vera Cruz. Many adventurers, too, drifted into California.

Ships Bring Immigrants

The China trade and the northern whale fisheries, from which many New England fortunes were made, aided also in this peaceful penetration. Navigators on the Pacific learned that "great circle" sailing from Cape Horn to China took their ships close to the California coast. They always needed fresh water, and sought to fill their barrels at California ports. Their men, often sick from diseases that come from lack of fresh vegetables, found new health in the potatoes and fruits grown by California ranchers. In vain, Spain and Mexico forbade the trade. Vessels continued to anchor at the ports of San Diego and Monterey. Often sick sailors were left ashore; and able-bodied seamen deserted their ships.

Casual foreigners were soon to be found in every pueblo. They married daughters of Mexican ranchers, officers, and officials, and began to introduce "Yankee" notions of enterprise among the leisure-loving natives. Now and then fur traders climbed the Sierras and came down into the paradise of California. Jedediah Smith visited it more than once. John Sutter became a Mexican citizen without losing his desire for contacts with the outside world. When John C. Fremont explored the country (1843–44) looking for a great river to the Pacific, he found both hospitable residents who spoke his language, and bewildered Mexican officials who did not know how to make him leave.

Before the Mexican War opened in 1846, Texas was already in the United States, New Mexico was filled with American ideas, and California was coming under American influence. The Spanish system that had raised up the Southwest as a buffer to outside influences had broken down, and the Southwest would soon have been absorbed as a part of the Union without hostilities. (*See* Mexican War.)

Yet in a sense, the Southwest conquered its invaders, for Spanish influences—names, architecture, and the manner of life in a gentle climate—made this wonderful region unlike any other in the United States. (*See also* Cattle; Far West; Indians, American.)

SOY BEAN. The soy (or soya) bean is said today to have more uses than any other known plant. Yet, until recent years, United States farmers grew it only occasionally as a rotation crop which put nitrates back into the soil and was useful at the same time for forage. The discovery of the many other possible uses of the soy bean was the work of chemists and food specialists, though much of what they found out scientifically had been learned long ago by practical experience in the Orient, the native home of the plant.

Soy beans contain all the vitamins, especially "B," and twice as much protein and fat as beef. They are almost free of starch and sugar, and so can be fed to diabetics. They produce a milk more digestible than cow's milk. Other food products made from soy beans are coffee substitutes, cheese, macaroni, pancake flour, sausage filler, lard and butter substitutes, salad and cooking oil, and soy sauce or *shoyu*. The pulp or cake, called soy-bean meal, is a good fertilizer.

In industry, soy-bean oil has become a rival of cottonseed oil and linseed oil. It is used in paints, varnishes, enamels, soap, linoleum, and printing ink. The protein from the soy bean resembles casein from cow's milk, and is used in paints, paper sizing, glue, and waterproofing for textiles. This protein, combined with formaldehyde, yields plastics for making automobile parts, notably gearshift knobs, window strips, and push buttons. Henry Ford was a pioneer in developing the industrial uses of soy beans.

The scientific name of the soy bean is *Soja max.* It is two to four feet tall, with branching stems and three-parted leaves. The small lilac-colored flowers mature into pods containing from two to five beans. Stems, leaves, and pods are covered with stiff reddish hairs. Manchuria is the chief source of soy beans in the Orient (*see* Manchuria). The beans provide the protein otherwise lacking in the meatless diet of the poorer people of Japan and China. Hundreds of varieties are cultivated. The United States, into which the plants were introduced in 1804, cultivates about 60 varieties. The soy bean has become one of the nation's leading cash crops, with the Middle West as the producing area.

ROMANTIC SPAIN — *Once* MISTRESS *of* HALF *the* WORLD

Street Dancers of Granada, with the Alhambra in the Distance

SPAIN. Until recent years Spain was a sleeping land, wrapped in the romantic customs of a bygone age. Once, centuries ago, Spain ruled half the world. From its rich colonies in the Americas, great treasure galleons brought cargoes of silver and gold to make it one of the wealthiest nations in Europe. Then the colonies were lost, one by one; but Spain made no effort to change to new ways. While other countries briskly built up industry and commerce, proud Spain clung to its lordly feudalism, and grew ever weaker, poorer.

Then suddenly Spain was jolted out of its long sleep by the Spanish-American War. Aroused at last, it began the enormous task of making itself into a modern country. This new Spain improved its roads, its schools, its agricultural methods. In 1931 it took a great forward step, for then it threw off its autocratic monarchy and set up a republican government. Even under the crushing burden of a long and destructive civil war, which fell upon it in 1936, Spain courageously continued to build itself anew.

Extent.—East to west, greatest distance, about 650 miles; north to south, about 550 miles. Area, 190,050 square miles; with Balearic Islands, Canary Islands, etc., 194,800 square miles. Population, about 23,600,000. Colonies (in Africa), over 128,000 square miles; population, about 900,000.

Physical Features.—Pyrenees, separating Spain from France; Cantabrian Mountains, Sierra de Guadarrama, Sierra de Gredos. Sierra de Gata, Montes de Toledo, Sierra Morena, dividing and bounding the central plateau; Sierra Nevada to the south (highest point, Mulhacen, about 11,420 feet). Chief rivers, Tor, Llobregat, Ebro, Guadalaviar, Jucar, and Segura, flowing into the Mediterranean; and the Minho, Douro, Tagus, Guadiana, and Guadalquivir, flowing into the Atlantic Ocean.

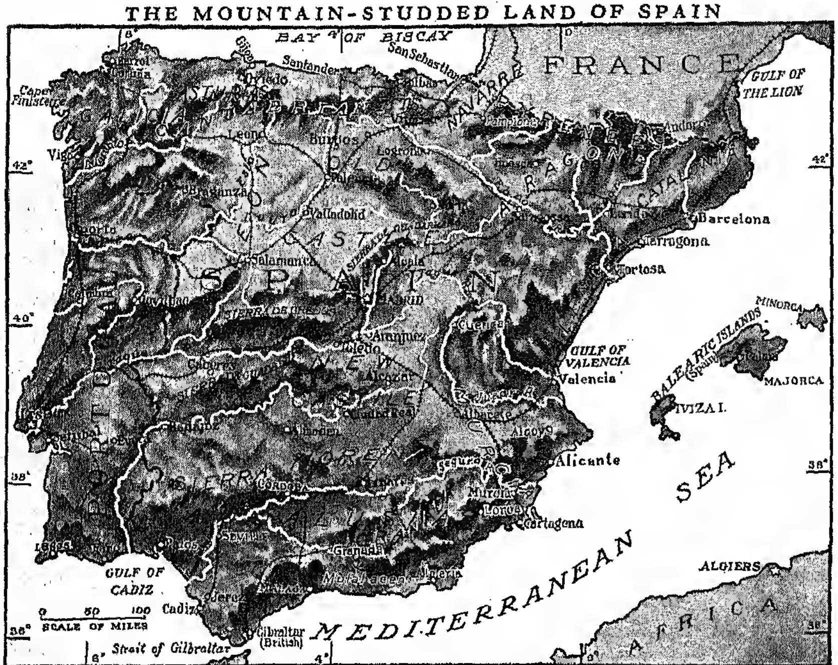
Products.—Wheat, barley, other cereals, cotton, sugar beets, sugar cane, vegetables, grapes and wine, olives and olive oil, oranges and other fruits, nuts; silk; sheep and goats, wool, other livestock; sardines, tunny fish, codfish; coal, lead, iron, copper, mercury, zinc, sulphur; cotton and woolen goods, paper, cork, glass, sugar, tobacco products, leather goods.

Cities.—Barcelona (1,000,000), Madrid (capital, 950,000), Valencia (320,000), Seville (230,000), Malaga, Saragossa, Bilbao, Murcia, Granada, Córdova, Cartagena (more than 100,000).

Cut off from the rest of Europe by the snow-crested Pyrenees, this ancient country of the Iberian Peninsula is in many ways like a world apart. Some regions are so gloriously beautiful that Spain came to be called "the land of romance." To the rest of the world, Spain meant a land warm with golden sunshine and gay with whirling dancers and gipsy music. But only a very little of the country is like that. It is one of the most mountainous countries of Europe. Most of its people are crowded into narrow strips of coastal lowlands along the Bay of Biscay to the north and the Mediterranean Sea to the south and east. Rising abruptly from the lowlands are great ranges of mountains that encircle the country like a ring. Thrusting up within this ring is a huge plateau, the Meseta. The towering peaks bar this plateau from the moisture of the Atlantic westerlies, making it a vast arid wasteland.

If you visit this country of contrasts, you will find it like northern Africa in many ways. A French prov-

THE MOUNTAIN-STUDDED LAND OF SPAIN



The map shows the historic names, such as Castile and Leon, which designate specific regions, as well as the principal cities and mountain ranges.

erb says that Europe ends at the Pyrenees Mountains and there Africa begins. The southern tip of Spain lies only some 12 miles from Africa and was once a part of it. Like northern Africa, Spain has an extensive coastline so regular that it offers comparatively few good harbors.

In visiting Spain you will not need to save much of your time for the central table-land, which—rising to an average height of nearly 2,700 feet, and punctuated by toothlike mountain ranges or sierras—occupies over half the actual area of the land. None of the great cities are there, except Madrid, the capital, and a few whose interest is chiefly historical. Toledo, which was once the capital, stands on a great ridge of granite, surrounded on three sides by the Tagus and on the other by medieval walls. Long lines of frowning stone buildings are terraced around the slope, and the summit is crowned by the huge cube of the Alcazar, or old palace, which was severely damaged in the civil war of 1936. The fine Gothic cathedral is the seat of the primate of Spain. Some of the many other churches are famous for their paintings by the great El Greco. Saragossa, once the capital of the kingdom of Aragon, is a flourishing modern city. Like Toledo, it has its Gothic cathedral and its Moorish castle, and boasts a university founded in 1474. Salamanca, on the Tormes River, is the oldest and most famous of Spain's university towns, and the one which introduced Arabic learning into Europe. Burgos, at the foot of the mountains to the north, is dominated by its Gothic cathedral, the most elaborate in all Spain, and by its romantic memories of that famous Spanish warrior the Cid, who had so many successful encounters with the Mohammedan Moors.

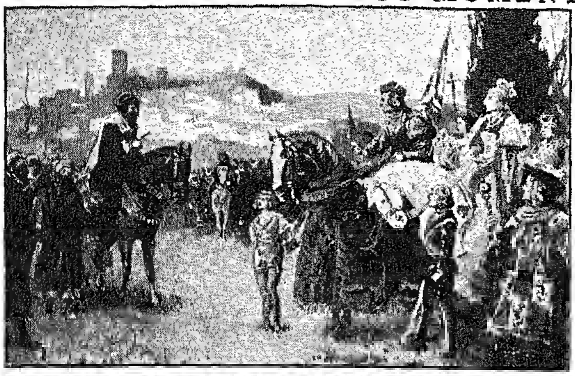
The chief industry of this dreary plateau is represented by the sheep that roam all summer long in flocks of 10,000 tended by shepherds dressed in sheepskin jackets and leather breeches. Scarcely a tree is to be seen in these regions, for ruthless deforestation, practiced through the centuries, has stripped all but six per cent of the land of the great forests which once covered it. Treeless, windswept, dusty, exposed to great extremes of cold and heat, this plateau is one of the most thinly populated sections of Europe.

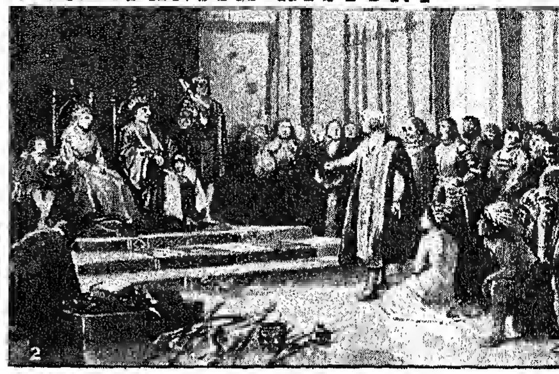
But the coast regions of Spain tell a different story. There you will find numerous large cities and active industries. If you cross the Pyrenees from France at the west—there are now railways at both ends—you will come out on the lands bordering the Bay of

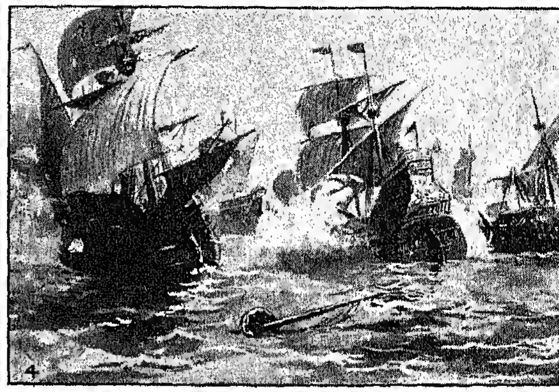
SPANISH MULES AND THEIR PACKS

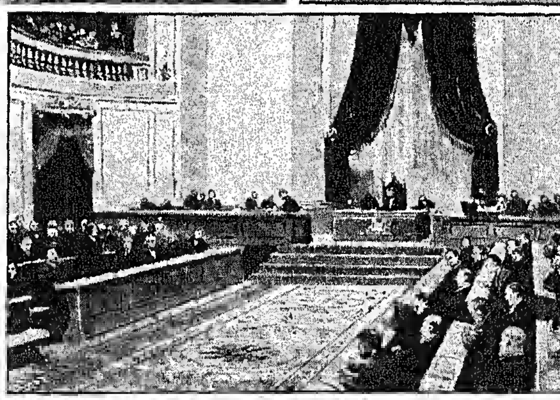
As in other mountainous, industrially backward countries, the sure-footed mule is an important factor in the internal trade of Spain. These patient beasts carry loads larger than themselves.

FIVE DRAMATIC MOMENTS IN SPANISH HISTORY









After enduring nearly seven and a half centuries, Moorish rule in Spain ended in 1492 with the surrender of Granada to Ferdinand of Aragon (1). As Boabdil, the last Moorish king of Granada, turned to take his last look at the city, he burst into tears. "Right my son," tauntingly exclaimed his mother, "weep like a woman for the throne which you had not the spirit to defend as a man and a king!" That same year Columbus set out on the voyage which ended in the discovery of the New World. In the next picture (2) we see him on his return in 1493 showing Ferdinand and Isabella the trophies of his bold expedition. Under Charles V, who ruled Germany, the Netherlands, and Naples and Sicily, as well as Spain, Spanish power reached its height. The third picture shows Pizarro, the conqueror of Peru, winning the approval of Charles for the projects which added enormous conquests to Spain's possessions in the New World. After Charles V, Spain's star declined. With the defeat in 1588 of the Great Armada (4), her sea power was broken and the flood of treasure which had been pouring in from the New World gradually ebbed. But the autocracy which had brought Spain so low was ended in 1812, when the Cortes (5) enacted a constitution, and a better day founded on democratic ideals began to dawn.

Biscay, which are among the wettest in Europe. The annual rainfall is from 40 to more than 60 inches in some areas. The climate is mild all year and roses bloom at Christmas as in midsummer. Both iron and coal are abundant. The three Basque provinces alone, nestling at the foot of the Pyrenees, produce annually more than half the iron that is mined in Spain. And they have other active industries—grape-growing for wine, apples for cider, and fishing; and if the chief catch of the intrepid Basque fishermen is now the sardines that they find in their "rias" or fiordlike inlets, it is only because whales have disappeared from this neighborhood.

The Basques themselves are a mysterious people, about whose origin scholars have long been speculating. Their racial characteristics distinguish them even when they migrate with other Spaniards or Frenchmen to America, and their language differs from neighboring tongues not only in its words but in the very type of its grammar. Most students believe that the Basques are a remnant of a pre-Indo-Germanic race that the Greeks and Romans found in Spain and called Iberians. The Basques in France and Spain today number about 600,000.

If you cross the Pyrenees at their eastern end, you come upon Barcelona and other densely populated coast towns, where manufacturing, particularly the weaving of cotton, goes busily on. The Balearic Islands, lying obliquely off this coast, are a center for the manufacture of shoes.

Farther south on this coast lies the great garden region of Spain, centering in Valencia. The climate is hot and dry almost beyond human endurance, but by means of irrigation channels introduced centuries ago by the Moors, the fertile soil is made to yield in tropical luxuriance grains, sugar cane, oranges, lemons, citrons, figs, dates, pomegranates, tomatoes, melons, and grapes. Mulberries, too, grow here in abundance, making Valencia the chief seat of the Spanish silk culture and manufacture.

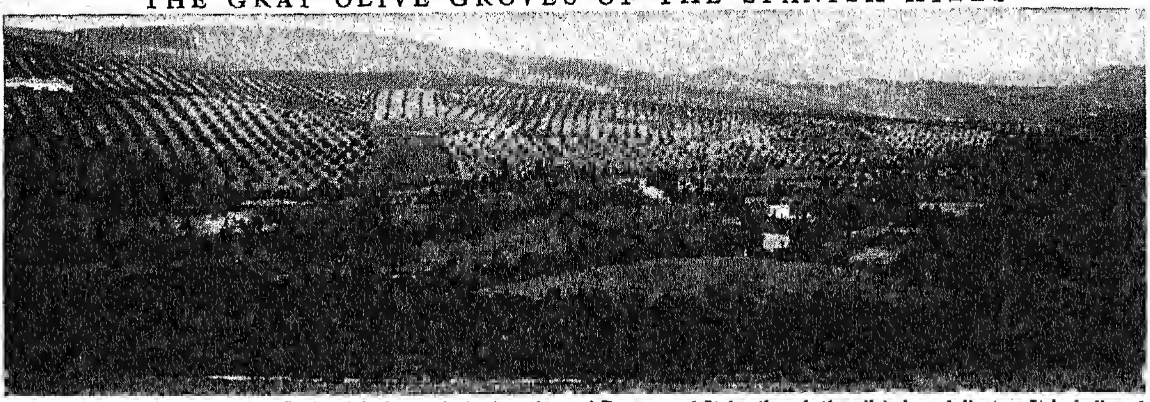
The Region of Which the Poets Sing

The southern provinces of Spain, known as Andalusia, form the beautiful region of which poets sing. Here lies the picturesque Moorish city of Granada, the splendid capital of the Moorish province which held out for 200 years after the Moors had been driven from the rest of Spain. It was once a city of 400,000 inhabitants, but now it is reduced to about one-fourth that size. Its chief glory is the palace of the Alhambra, the most perfect relic of Moorish art. (*See* Alhambra.) Cordoba, or Cordova, once one of the greatest commercial centers of the world, is still famed for its Cordovan leather and olive oil. Cadiz, said to be the oldest town of continuous existence in Europe, was founded about 1100 B.C. by the Phoenicians under the name of Gadir. It remained an important city for thousands of years, having its final burst of splendor in the 18th century, when it held the monopoly of trade with Spanish America.

The south of Spain is also the country of famous wines, malaga and sherry (named from Jerez), although wine is to a great extent an industry of all the 49 provinces. Even the central plateau in places is irrigated for grape-growing. In these tropical regions you will everywhere see lizards, sometimes three feet long, and scorpions, and you may walk through stately forests of cork oak whose bark is one of the chief products of the country.

Next to agriculture, mining is the greatest source of Spain's wealth. Its mountains yield an astonishing variety of minerals, including copper, iron, lead, manganese, zinc, antimony, fluorspar, sulphur, and potash. Spain has the world's largest and richest deposits of mercury, and its coal reserves are vast. The bulk of the mineral production is exported to other countries. Coal, however, is not mined in sufficient quantities to meet the domestic demand and there are considerable imports of coal from Great Britain. Some water power has been developed.

THE GRAY OLIVE GROVES OF THE SPANISH HILLS



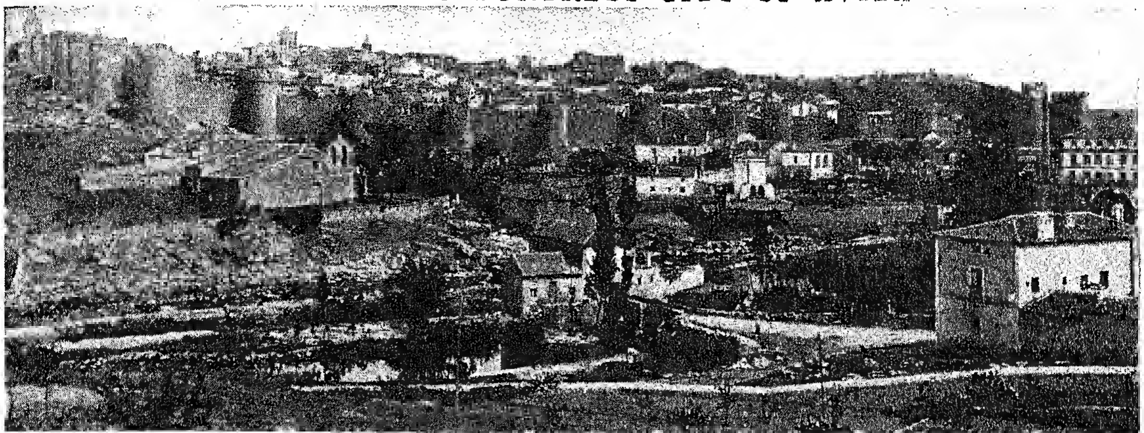
The broad-leaved olive trees of Spain yield larger fruit than those of France and Italy, though the oil is less delicate. It is believed that the Phoenicians introduced the olive into southern Spain.

Railways are still too few for the needs of the country, and in the remoter parts ox teams and mule trains are the only means of transport. The leading manufactures are iron and steel, cotton goods, paper, glass, sugar, cork products, and silk.

Handicaps to National Progress

Spain's industrial backwardness, despite its natural wealth, is due to the character of its surface and its people. The great barrier of the Pyrenees, passable only in a few places, has kept the country from becoming a cross-roads of commerce between Africa and the rest of Europe; while its many ranges of east-to-west interior mountains and its unnavigable streams have isolated its people into sharply differentiated groups, speaking different dialects and languages. It was not until the 16th century that political unification was accomplished, and even today the differences of customs, sentiment, and economic organization are so marked that Spain is a nation divided against itself, with bitter regional and political animosities. Other factors too have handicapped Spain—the rigors of the Inquisition, which stamped out individual initiative; the neglect of trade and industry in the quest of gold in the New World; unwise monetary policies; and the depopulation which resulted from centuries of warfare. Spain today is as thinly populated as Ireland; with twice the area of the British Isles, it has only half as many inhabitants. Economic progress has also been greatly retarded by illiteracy. Until a few years ago about half of the Spanish people were unable to read, but this proportion is now being slowly reduced. Spain has eleven universities, including Madrid, the largest, and Salamanca, the oldest, where Christopher Columbus once lectured on his discoveries.

THE ANCIENT FORTRESS CITY OF AVILA



On the flat summit of a bleak hill, commanding a desert landscape of austere and rugged beauty, rise the ancient towered walls of Avila, birthplace of Santa Teresa and one of the most remarkable of Spanish inland fortress cities. The granite walls are 40 feet high, 13 feet thick, and about 4 miles around, though much of the city lies outside of them. It is said that 200 men could stand on each of the 86 towers.

The pageant of Spain's past is as picturesque and full of contrasts as the country itself. Ten centuries before our era the Phoenicians sought its shores in their tiny ships for iron and tin. Five hundred years later Carthage colonized the land and held it until Rome's galleys and armies drove out the Carthaginians in 201 B.C. Then came six centuries of Roman colonization and government, during which most of its cities were founded and Spain grew to nearly three times the population it supports today. Two Roman emperors, Trajan and Hadrian, were Spanish born, and Spain contributed practically all the greater authors of the "silver age" of Latin literature. The bull fight, Spain's most popular diversion today, is really a survival from the Roman wild beast shows of ancient days.

With the 5th century A.D. began 300 years of subjection to barbarian conquerors—the Vandals, who gave their name to Andalusia (Vandalusia), the Suevi, and the Visigoths. The Visigothic period (415–711) ends with the great battle of Jerez de la Frontera (711) in which Moorish invaders from Africa overthrew the Goths and established a Mohammedan power which lasted over seven centuries.

The Moorish period represents a stage in the pageant of Spanish history almost richer than the time

WHERE FASCIST GUNS AIMED IN CIVIL WAR

Built largely since the World War, the Gran Via, a broad modern thoroughfare in Madrid, slashes its way through the old winding streets. During the Civil War in Spain, the telephone building in the foreground, with its American style set-back architecture, was the chief target for the fascist artillery. All the near-by buildings were scarred and pitted by shrapnel.

of the Romans, and the development that the Moors gave the land has persisted to our own day. They made the arid soil of Spain blossom like the rose, and the old Roman cities built over again on Arabic lines began to develop graceful palaces and vast mosques with domes and minarets. Fine metal work and silk and leather work as beautiful as any from the Orient came out of Spain, and a Toledo blade became as desirable as one from Damascus.

Christian kingdoms meantime were formed in the northern mountains and were nibbling bit by bit from the Moorish domains. The kingdom of Asturias on the Bay of Biscay, which later expanded into the kingdom of Leon and Castile, was the cradle of Spanish liberty. Soon Aragon, Navarre, and the county of Barcelona (Catalonia), at the foot of the Pyrenees, and Portugal on the Atlantic, arose to join in the age-long battle to free Spain from the infidel. In the battle of the plains of Tolosa (1212) the combined kingdom of Castile and Leon practically broke the Moorish power and shut it up in the small Mohammedan kingdom of Granada.

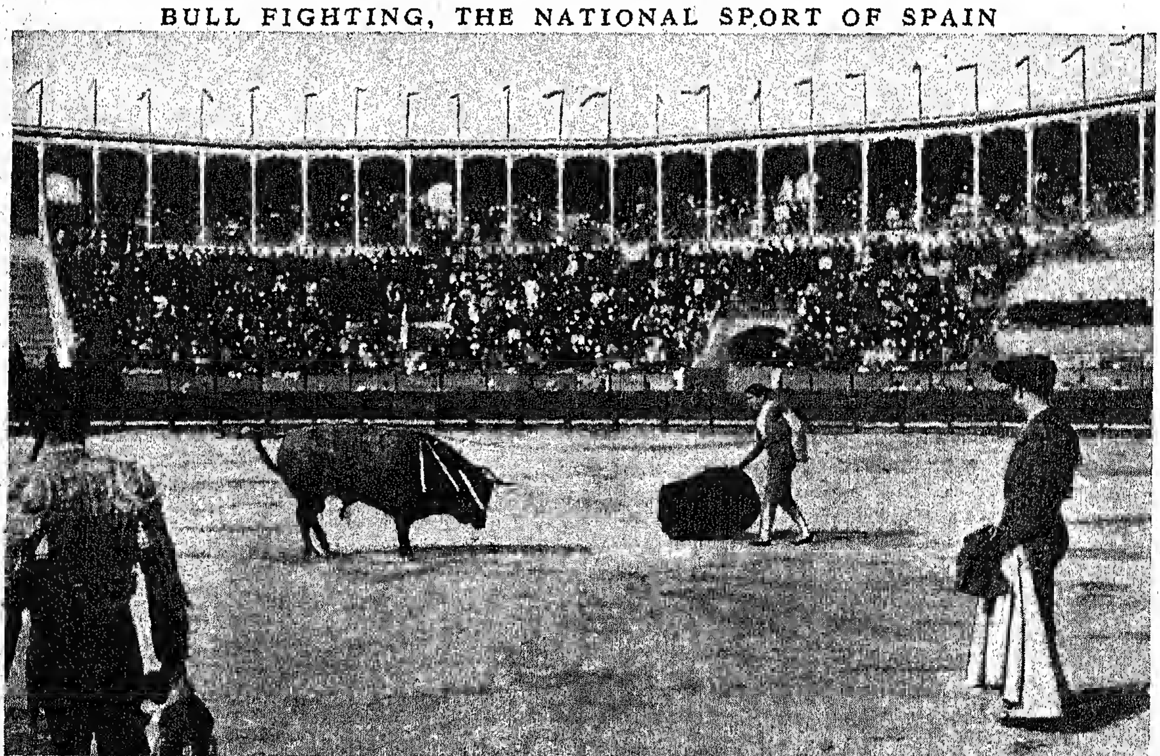
From this period come the great tales of chivalry. Among these are the songs and stories of the brave Christian knight the "Cid" (meaning "commander" —his real name was Rodrigo Ruy Diaz de Bivar)— who in the 11th century did so many deeds of prowess in behalf of his master the king of Castile.

With the marriage in 1469 of Ferdinand of Aragon and Isabella of Castile, most of Spain was united under a single rule. In 1492—the year Columbus gave the New World to the Spanish crown—came the final expulsion of the Moors from Spain through the conquest of Granada. In 1512 the Spanish part of Navarre was conquered. Philip II seized Portugal in 1580, and Spain held it for 60 years. Only the tiny mountain republic of Andorra remained free.

Under the grandson of Ferdinand and Isabella, Charles I of Spain—better known as Emperor Charles V—Spain became mistress of most of the world. Charles V ruled Spain, Naples and Sicily, the duchy of Milan, and the Netherlands, and was the imperial lord of Germany as well as of the treasure countries of the New World. With his son Philip II, the Inquisition spread its baneful influence over Spain. Moors and Jews were expelled, and Protestants and even Catholic Spaniards were tortured and burned at the stake in terrible bonfires known as the *autos da fe* or acts of faith. Freedom of thought and initiative were crushed at the same time that the resources of the kingdom were permanently impaired in the vain attempt to suppress Protestantism in other lands. (*See* Armada, Spanish.)

After the time of Philip II Spain steadily declined in power. The War of the Spanish Succession (1701–14) cost it most of its outlying possessions in Europe and

BULL FIGHTING, THE NATIONAL SPORT OF SPAIN



Bull fighting is to the Spaniard what baseball is to the American. Every fine Sunday afternoon in nearly every city of the land immense throngs assemble for their favorite amusement. Everyone knows the curious old formalities and rules according to which the contests are conducted, and is as familiar with the exploits and the special abilities of the famous matadors as any American is with those of the baseball stars of the day. The matador in the center of this picture is watching his opportunity to rush and deliver the final stroke with the sword which he holds concealed under his cloak.

HAPPY CHILDREN OF MADRID IN PRE-WAR DAYS

Before the civil war of 1936–39 afflicted Spain with privation and suffering, every bright day saw crowds of smiling children and nurses on the famous Prado of Madrid. Notice the frilly caps of the nurses and the dangling braids of hair.

seated a French Bourbon prince on its throne. From 1714 to the outbreak of the French Revolution, Spain was little more than a satellite of France. In 1808 Napoleon placed his brother Joseph on the throne of Spain, and the outraged Spaniards revolted. Aided by the British, they freed the country from Bonaparte rule in the Peninsular War (1808–14). At the same time a liberal constitution was adopted (1812), but Ferdinand VII abrogated it when he returned to the throne. By the end of his reign—he died in 1833—Spain had lost all its vast empire in the New World except Cuba and Porto Rico, and these were lost in the Spanish-American War of 1898 (*see* Spanish-American War).

As the old absolutist Spain decayed, a new and more liberal Spain was struggling forward. Conflicts between liberals and reactionaries brought alternate years of revolutionary movements and periods of constitutional government. From 1873 to 1875 Spain was a republic, but in 1875 the Bourbon monarchy was restored. In 1876 a new constitution was adopted.

THE CHARM OF SIMPLICITY

Spanish rustic interiors, such as that of the village inn above, delight the eye with rough plaster walls, bright copper, hanging corn and peppers.

The struggle for democratic, or even constitutional government, was especially difficult in Spain because the country was not thoroughly united. There were said to be as many Spains within its boundaries as there were regions with their local leaders. Indeed, the word *Spanish* today denotes no definite national type, but a variety of types with different dialects and characteristics. A powerful military organization was saddled upon the people, and church control was strongly entrenched. Both army and church were stanch supports of the monarchy.

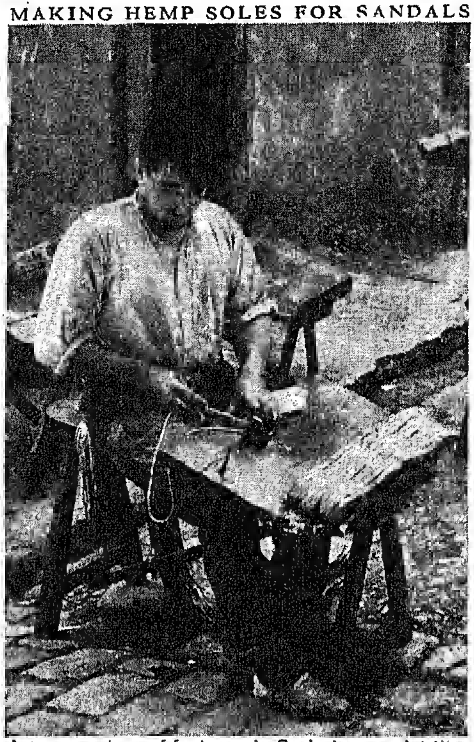
During the World War of 1914–1918 Spain was neutral, but it expanded its industries to supply the needs of the Allies. After the war, the loss of markets for war materials and the collapse of prices of Spanish food exports brought depression. The weak government was unable to cope with the depression, to

settle the strikes which tied up industry, or to put down a rebellion in Spanish Morocco, which had been continuing at enormous cost for several years.

Gen. Primo de Rivera, following the example of Mussolini in Italy, seized power in 1923, suspended the constitution, suppressed political parties, and set up a fascist form of government. With French aid, he put down the Moroccan revolt. He made strikes illegal, aided in founding new industries, built many miles of excellent automobile highways, and attempted other reforms. For a time conditions in Spain, like conditions elsewhere in Europe, improved. But renewed world-wide depression after 1929 brought renewed depression to Spain. De Rivera attempted to reform the inefficient Spanish army, thus losing its support and that of the king. He resigned in 1930.

Opposition to the fascist dictatorship now turned into opposition to the monarchy. Republican parties won an overwhelming victory in the municipal elections of 1931. King Alfonso fled (*see* Alfonso), and a provisional republican government under President Niceto Alcalá-Zamora took control.

MAKING HEMP SOLES FOR SANDALS



A common type of footwear in Spain is a sandal-like shoe (*alpargata*) with thick, tough soles of plaited hemp.

Problems Facing Republican Spain

The young republic faced the problems of modernizing a country which had fallen far behind in the march of progress. Cut off by mountains and the sea from the rest of Europe, it had adopted few of the reforms which through the centuries had changed the way of life in other lands. Thus the new government faced not only the problems common to other governments today, but many which other governments had solved decades or centuries before.

Most difficult were the problems of the farmers. Three-fourths of the Spanish population get their living directly from agriculture. Yet Spanish farming methods have changed little since the Middle Ages. While other countries have improved their plant seeds and animal stocks by selective breeding, Spanish plants and animals remain smaller, less valuable, less resistant to drought and disease. With most Spanish farmers unable to read or write, agricultural education has made little progress.

Average rainfall in Spain is only a little more than the minimum necessary to support planted crops. In the north especially, where less rain falls than anywhere else in western Europe, droughts are frequent and disastrous. Seeds better able to resist drought, and great irrigation works were needed, so that food crops could be grown where now sheep and goats find poor pasture.

Only 27 per cent of Spanish land is devoted to crops. A large part of Spain is too hilly for planting, but much good land could be brought under the plow by modern methods. In other countries where rainfall is light, dry-farming methods, including deep and frequent plowing, make good crops possible. For deep plowing, horses, oxen, or tractors are needed. Spanish plows are drawn for the most part by mules, which are too small for this heavy work.

In earlier years the forests covering Spanish hillsides had been cut down to clear the land for crops. But erosion by rain and wind soon stripped the hillsides of their fertile soil. Thus many sections were left with neither trees nor soil. Both reforestation and improved methods of controlling erosion were badly needed.

In the lowlands bordering the ocean, olives, oranges, and other tree-crops are grown in abundance. Spanish olives are larger and firmer than others. But inferior methods of preparing for market and marketing handicap the growers. Coöperative organizations to pick, sort, grade, package, and market farm products were started in Spain almost a century ago, but made so little progress that other countries, with more advanced methods, captured the world's markets.

System of Land Holding a Handicap

The almost feudal nature of Spanish landownership was a chief obstacle to the improvement of farming methods. In the south, huge estates were owned by nobles and great landlords, who lived in Madrid or abroad and took no interest in their land. In the north and northwest, the land was divided into such small holdings that the farmer could not gain a living for his family and was unable to improve his methods. Authorities estimate that 2 per cent of the landowners owned 67 per cent of the land, and thousands of farms covered less than one acre. Many farmers rented their land from feudal estate-owners. They did not improve it, for improvement meant to them only higher rents. In addition, 3 million landless workers tilled the land of others for wages ranging from 14 to 60 cents a day. Thus, although some great estates were efficiently managed, and some small farmers made a good living,

A FARMHOUSE IN THE FOOTHILLS OF THE PYRENEES

Picturesque whitewashed dwellings of native stone and brick shelter the peasant farmers who make a meager living in this hilly country. The farm animals are stabled under the family's living quarters. The large chimney suggests the roomy fireplace beneath it.

methods were generally backward and yields small.

The poverty of Spanish farmers and farm workers was a handicap to industry, since it kept them from buying manufactured products. After 1900, many great industries were founded, especially in Madrid, Barcelona, and cities in the north. But these industries produced chiefly for export and for the well-to-do. After the World War, exports were increasingly hard to maintain. Spanish mines yielded rich stores of coal, iron, and copper; Spanish rivers had been harnessed to create electrical power; labor was cheap and plentiful; but markets were available neither at home nor abroad.

Spain's industrial laborers also suffered because of the poverty of the farmers. Employers were able to keep wages low because landless farm workers and farmers with too little land to support their families flocked to the cities to work in factories for the barest living wage. Thus trained city workers had to compete for jobs with farm workers whose wages were even lower.

Radical Movements Grow

Failing to get better wages and working conditions by peaceful methods, labor unions turned to strikes and violence. In Madrid many workers became socialists, holding that only state ownership could improve their lot. In Barcelona many turned to anarchism, the belief that all government should be abolished, and to syndicalism, which aims at putting workers' organizations in control of industry. The resulting labor disputes further unsettled the country and interfered with production.

One great obstacle in the way of improvement was the backwardness of education. When the republic was established in 1931, almost half the Spanish people were unable to read and write. An estimated 27,000 schools were needed merely to take care of children who had no schools at all. In addition, new schools were needed for adults who had had no education when young, and agricultural and industrial schools for farmers and workers. With so many unable to read or write, no great program of national improvement could capture the imagination and support of the whole country.

Another obstacle was the army, which had long been active in politics as the chief prop of the monarchy and the dictatorship. A large proportion of the government's budget went to support the army. In it one soldier in ten was an officer. The most efficient branch was the Civil Guard, used to suppress uprisings among the Spanish people themselves. Drawn largely from among the sons of the nobility, the landowners, and other officers, the army officers used their political power to oppose all reforms. Reorganization of the army was one of the first problems facing the new government.

TAKING STRAW TO MARKET IN ANDALUSIA

Modern transportation devices have not reached the Spanish farmer, though in many places he trundles his two-wheeled ox-carts over modern roads.

SHEEP HAVE GRAZED THIS LAND FOR MORE THAN 2,000 YEARS

This flock is feeding in the highlands north of Madrid, a part of Spain's great central plateau where much of the land is unfit for farming. Sheep grazing is Spain's oldest industry, famous in Roman days. A large proportion of the sheep in North and South America are descendants of Merino flocks imported from Spain in colonial days and later.

The position of the church in the life of Spain created many grave problems for the new government, for the church played a leading part in social, educational, economic, and political affairs. Half the schools were managed by religious orders; nuns had charge of hospital nursing and the care of the poor. The dioceses and religious orders owned or controlled much land and many industries; they made loans to farmers and business men; they received subsidies from the state and their property was exempt from taxation. Thus, when the new government undertook to disestablish the church—separate it from state affairs and deprive it of both its duties and its privileges—a far-reaching upheaval was caused and violent opposition was aroused.

Furthermore, the new government was crippled by the fact that Spain was not a united nation. In many provinces, notably in Catalonia, Galicia, and the Basque country at the north, there were strong movements for *autonomy*, or partial independence from the central government at Madrid.

How Poor Transportation Hindered

This and many other problems were made more difficult by the lack of good transportation. The most mountainous country in Europe, except Switzerland, Spain can build roads and railroads only at great expense. A Spanish railroad has to travel on the average more than two miles up, down, and around in order to cover one mile as the crow flies. This so increases the cost of trade between different parts of Spain that business is greatly handicapped. For example, half the cost of coal in Madrid is due to the cost of transporting it from the mines in Asturias. Outlying provinces thus became self-sufficient or relied on foreign trade rather than on trade with other parts of Spain. Railroad communication with the rest of Europe is handicapped because the Spanish rails had been laid wider than the European standard to hinder invasion by possible foes. This makes it necessary to reload all trains at the French border.

Government finances were in wretched shape. Interest on the huge public debt took much of the income from taxation. Imports, chiefly of manufactured goods, exceeded exports, chiefly of farm products. To pay for the surplus of imports, money was borrowed abroad, further adding to the foreign debt. Many of the greatest Spanish industries were built by foreign capital, and interest on these foreign investments had to be sent abroad. Finally, with the fall of De Rivera, Spanish nobles and landowners shipped abroad as much of their money and possessions as possible, thus further impoverishing the country. The value of the Spanish *peseta* fell to less than half its normal value as a result of these disturbing influences.

The Republic Attempts Reforms

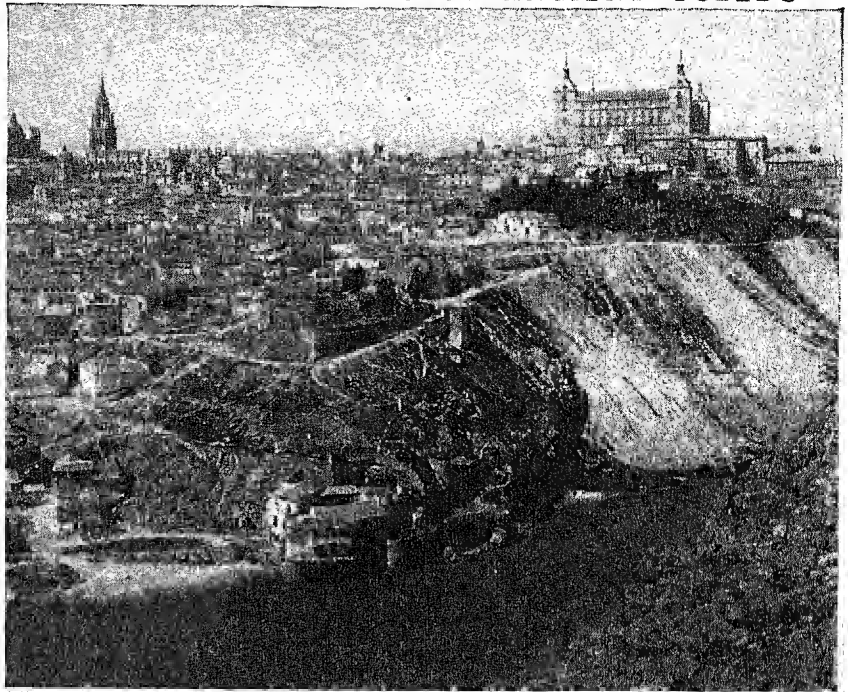
As its first step in attacking these many difficult problems, the young republic adopted a new constitution, drawn up by Spanish intellectuals who had studied the governments of other nations. This constitution provided for a single house of parliament, the *Cortes;* a president elected every six years and subject to removal by the *Cortes*, and a cabinet under a premier who was responsible to the *Cortes* and could be removed by it. It gave the vote to everyone over 23, provided for the separation of church and state, made education for all free and compulsory, and guaranteed freedom of speech, of religion, and of the press. It renounced war as an instrument of national policy, and it promised to establish government by "workers of all classes." Although this constitution embodied the best features of the constitutions of other democracies, many felt that it did not meet the needs of a people almost wholly without experience in the art of self-government.

Under the new constitution, President Alcalá-Zamora and Premier Manuel Azaña began their work of reform. In rapid order laws were passed reducing the cost and personnel of the army, depriving the church and the religious orders of privileges and of some of their property, abolishing feudal land duties,

establishing new schools, protecting the rights of labor to organize and demand higher wages, and providing for the breaking up of great estates with payment to former owners.

But the passing of laws by the *Cortes* was not always followed by immediate action throughout the nation. Many local governments were controlled by men out of sympathy with the new laws. Some of the laws could be applied in some provinces but not in others. The government had neither money nor credit enough to pay for its reforms. It was further handicapped because the nation had speedily split into a score or more of parties, each with different and opposing aims.

THE ROCKY HEIGHTS OF ANCIENT TOLEDO



Like an ancient fortress surrounded by a moat, Toledo climbs up the side of a great granite hill, with the swirling waters of the River Tagus protecting it on three sides. The famous old city has long been noted for its fine churches and its fine sword blades. At the right we see the Alcazar, the old citadel which was partly destroyed in 1936 in the course of the civil war.

Many Small Parties

On the right side of the *Cortes* sat the conservatives, representing the monarchists, the landowners, the church, the army, and others who feared the new reforms. In the center sat liberals and republicans eager to maintain democratic forms of government and to improve conditions gradually by constitutional means. On the left sat socialists, communists, and other radical groups. In addition, representatives from the dissatisfied provinces formed their own parties to protect regional interests. Only a few members represented the middle class, for this class, which in other democratic countries furnishes the majority of political leaders, is small in Spain.

The first cabinet, formed by center parties with support of the moderate socialists, stayed in power for two years, despite growing opposition from the left parties, which felt that reforms were proceeding too slowly, and from the right parties, which felt that reforms were proceeding too fast or too far. In the elections of 1933, the left parties were divided, while those of the right united. The conservatives won, largely because they had the support of the six million women who voted in these elections for the first time.

Conservative Rule and Revolts

When the new cabinet headed by Alexander Lerroux came to power, it halted most of the more radical reforms begun by Azaña during his two years in office. Two new parties came into prominence, the fascists led by José Primo de Rivera, nephew of the former dictator, and the Catholic Action party led by José María Gil Robles. When Gil Robles was admitted to the cabinet, workers in the north feared that he would seize power as Hitler had in Germany, and therefore revolted. Moorish troops brought over from Africa suppressed the revolt with much cruelty, especially against the miners in Asturias. More than 25,000 were imprisoned. Thoroughly alarmed, the left parties now united into a "Popular Front" and won a sweeping victory in the election of February 1936.

Civil War Breaks Out

Civil war followed within a few weeks. In July, after a period when the police were unable to suppress disorder, army officers revolted throughout the country, carrying most of the soldiers with them. The entire country quickly took sides, the conservatives joining the rebels, the liberals holding to the Popular Front government under Premier Francisco Largo Caballero, a socialist. The Basques, though conservative and devoutly religious, remained loyal, fearing that the Fascists would never allow them autonomy. The Catalonians remained loyal, but gave little aid at first, although they were later to bear the brunt of the fighting.

The rebels organized and struck swiftly. Gen. Francisco Franco, starting from Spanish Morocco with Moorish troops on July 17, 1936, swept north to the gates of Madrid, where he was joined by Gen. Emilio Mola's northern army. By November the loyalists had organized a militia strong enough to save Madrid. The government moved to Valencia for safety. From

the beginning the war was incredibly fierce, with fanatical cruelty on both sides. Thousands of landowners, priests, and other rebel supporters were massacred by loyalists who were not always controlled by the central government. The rebels likewise slaughtered loyalist noncombatants and prisoners of war.

Other Nations Take Sides

Other European nations took a keen interest in the war's outcome, and the struggle constantly threatened to develop into a world conflict. Germany and Italy sought a rebel victory, hoping to exploit Spain's abundant natural resources and to obtain a stronghold in the Mediterranean. With Portugal as a base of supply, both nations supplied Franco with arms, ammunition, and bombing planes, and dispatched "volunteers" to the rebel army.

Soviet Russia aided the loyalists with arms, munitions, and technical experts. It also helped to recruit anti-fascist volunteers from all over the world to fight for the loyalist government. This "international brigade" of about 40,000 men, many of whom were Americans, rendered notable service to the loyalists in the defense of Madrid and in other early battles of the war.

Afraid of bringing on a general war, France adopted a policy of nonintervention, although it gave unofficial aid to the loyalists up to 1938. Great Britain favored neither side openly, fearing any foreign foothold in Spain. Under British leadership, an international nonintervention committee was organized in the spring of 1937, which undertook to patrol the land and sea frontiers of Spain. This control broke down, however, when the nonintervention agreements were openly violated by Italy and Germany.

General Franco's Victorious Drive

The year 1938 brought frightful destruction and slaughter. Italian and German airplanes repeatedly bombed Barcelona, the new loyalist capital, and Valencia, both of which were virtually defenseless. In April 1938, Franco's land forces pushed to the sea between these two cities, cutting loyalist Spain in two. There followed a swift succession of victories as General Franco's overwhelming superiority in materials and men began to take effect. In a vast aerial and land offensive on Catalonia, Franco captured Tortosa and Tarragona, and drove on to the loyalist capital. In January 1939 the insurgents took Barcelona almost without a fight.

The loyalist government fled and set up headquarters inside the French frontier. In one of the greatest mass flights in history, hundreds of thousands of republican soldiers and refugees streamed across the border to be herded into French concentration camps.

When France and England recognized the rebel government, loyalist military leaders in Madrid opened peace negotiations with General Franco. A communist uprising to force continuation of the war was quickly suppressed by loyalist General Miaja. On March 28, 1939, nationalist troops entered Madrid, and peace came to Spain after thirty-two months of civil war. It was estimated that more than a million men had been killed and 700,000 wounded, and that the war had cost about 40 billion dollars.

Postwar Developments

Setting up a fascist dictatorship, General Franco ruthlessly suppressed the remainder of the republican opposition. As "El Caudillo" ("the leader"), he assumed supreme power. His authority was exercised through the Falangist party, the only legal political party in the country.

Spain now joined Italy and Germany in the anti-Comintern pact, shortly before the outbreak of a general war in Europe. Though it declared its non-belligerency, Spain in 1940 sent troops into Tangier, with the consent of the other powers, to administer the city as an "international zone." (*See also* Europe; Franco, Francisco; and **Spain** in FACT-INDEX at the end of this volume.)

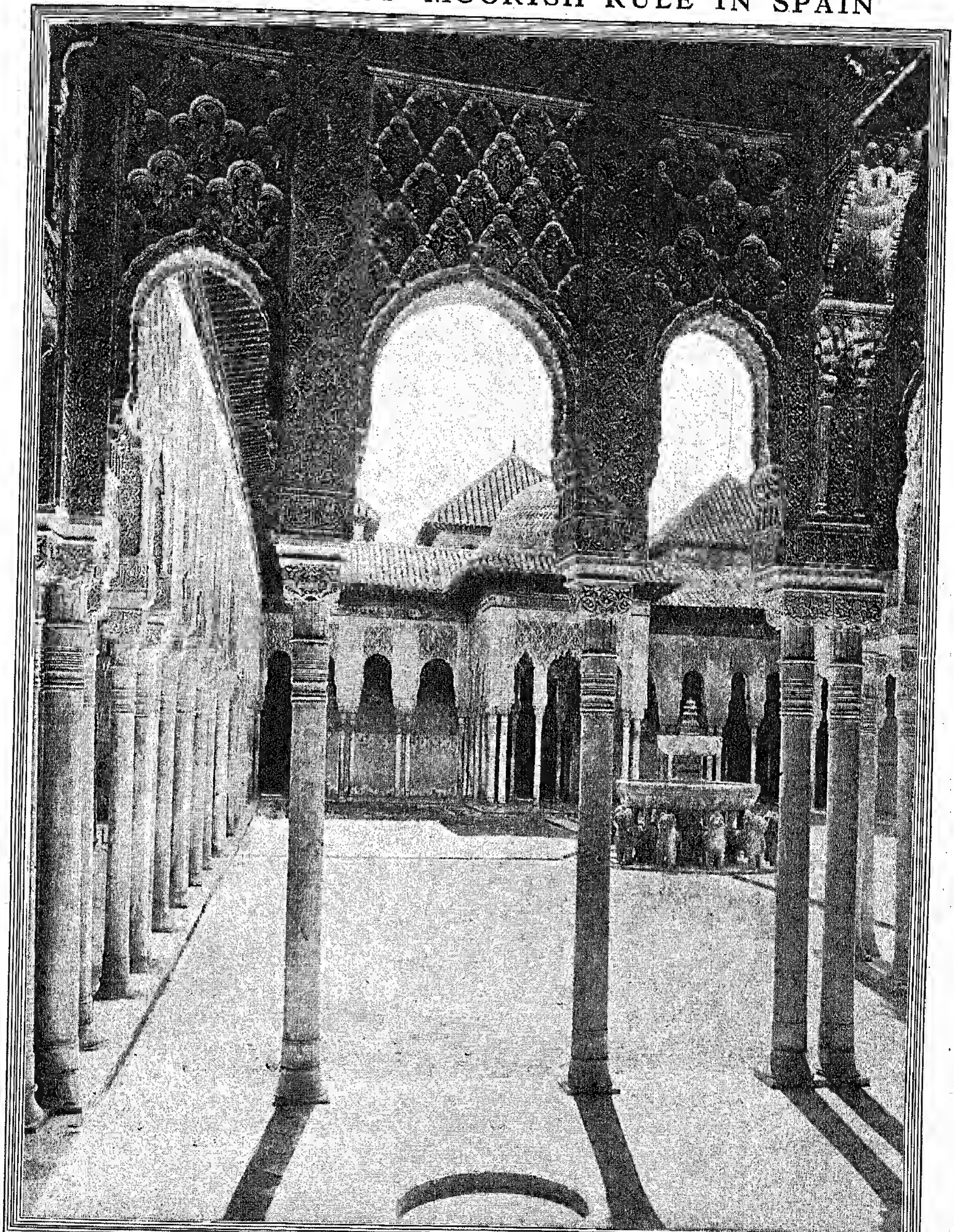
—REFERENCE-OUTLINE *for Organized Study of* SPAIN *and* PORTUGAL—

GEOGRAPHIC conditions, as well as the loss of rich colonies, have contributed to the decline of the once prosperous and powerful nations of the Iberian Peninsula to a secondary place in world affairs. Situated for the most part on a rugged, semibarren plateau, which makes transportation difficult and isolates different groups of people; cut off from the rest of Europe by the high wall of the Pyrenees; and with few natural harbors large enough for modern ocean-going ships, Spain and Portugal have been unable to compete with more favorably situated nations. Acute depression and political strife after the World War of 1914-1918 led to civil war in Spain in 1936-1939. Exhausted and broken, Spain emerged with a fascist dictatorship.

Spain

I. **PHYSIOGRAPHY:** **S-225–6, S-226 map, E-318 map.**
A. **Mountains: E-318 map.** Pyrenees P-372.
B **Central Plateau: S-226–7, S-228.**
C. **Rivers: S-225.** Guadalquivir S-86.
II. **CLIMATE: S-226–7, S-228.**
III. **RESOURCES, INDUSTRIES, AND PRODUCTS:**
A. **Agriculture and Grazing: S-226–8.** Irrigation V-268.
B. **Mining and Minerals: S-227, S-228, P-372.**
C. **Fishing: S-227.**
D. **Manufacturing: S-228.**
E. **Reasons for Industrial Backwardness: S-228.**
IV. **CHIEF CITIES: S-226.** Madrid (capital) M-22, S-229 picture; Barcelona B-45; Valencia V-268, S-228; Seville S-85; Granada S-228, S-225 and S-233 pictures; Toledo S-226, S-231*d* picture.
V. **POSSESSIONS:** Balearic Islands B-17, S-226 map; Canary Islands C-70; Spanish Morocco M-259; Rio de Oro and Rio Muni on West Coast of Africa (Fact-Index).
VI. **PEOPLE: E-318 population map, S-225 picture, S-231 picture.** Sharply Differentiated Groups with Different Customs and Characteristics S-228, S-231; Basques S-227; Moors M-255.
VII. **EDUCATION: S-228–9.**
VIII. **HISTORY: S-228–32, S-227 pictures.**
A. **Early Settlements and Peoples: S-229, F-171, P-174, C-88.**

A MEMORIAL OF MOORISH RULE IN SPAIN



The splendors of the gemlike buildings with which the Moors adorned Spain in the Middle Ages are still preserved for us in the slender columns, the delicate and intricate tracery, and the time-mellowed tints of the ancient Moorish palace and fortress of the Alhambra, in the city of Granada. Built in the 13th and 14th centuries, this was the last stronghold of the Moors in Spain, falling into the hands of Ferdinand in 1492. Of its many superb halls and courts perhaps the gem is the Court of Lions, pictured above, with its 124 columns surrounding the beautiful alabaster fountain, which is supported on the backs of twelve marble lions.

B. Barbarian Invasions: E-323. Vandals V-271; Goths G-123.
C. Mohammedan Conquest: S-229–30, M-214–16, M-255.
D. Independent Christian Kingdoms: E-323.
E. Consolidation of Spanish Kingdom: S-230, E-323.
  a. Union of Castile and Aragon: I-152, M-255. Discovery of New World by Columbus C-316; Ximenes de Cisneros and Spanish Expansion X-197.
  b. The Inquisition: I-80.
F. Charles V (Charles I of Spain) and His Empire: C-146–7. (*See also* Reference-Outlines for Geography, United States History.) Explorations and Conquests in the New World—Balboa B-15; Magellan M-27; Cortez C-372; Coronado C-370; De Soto D-55; Pizarro P-227a, P-140.
G. Philip II and Beginning of Spanish Decline: P-163.
  a. Revolt of Dutch Netherlands: N-72, W-103.
  b. Annexation of Portugal: P-314.
  c. Contest with Elizabeth of England: E-255. Defeat of Armada A-300–1; Sir Francis Drake D-91.
H. Disintegration of the Spanish Empire: Loss of Portugal P-314; War of the Spanish Succession L-202, M-66; Spanish Losses U-266, N-5, S-29, M-16.
I. Bourbon Dynasty: War of the Austrian Succession M-63; Seven Years' War S-84, L-208, F-194.
J. The Bonapartes: N-9, B-171. The Peninsular War N-10, W-71; Return of Ferdinand VII to Throne (Fact-Index).
K. Loss of Colonies: S-209, B-168, M-142*d*. Spanish-American War S-234–5, C-412.
L. Spanish Neutrality in the World War of 1914–18: S-231.
M. Alfonso XIII: A-118. Dictatorships S-231*a*.
N. Revolution of 1931: S-231*a*.
O. The Republic and Its Problems: S-231*a–d*.
P. Civil War and Foreign Intervention: S-231*d*-32.
Q. Fascist Régime Established: S-232. Franco F-187.

IX. SPANISH LITERATURE AND ART: S-235–8. (*See also* Reference-Outlines for Architecture, Language and Literature, Painting.)

Portugal

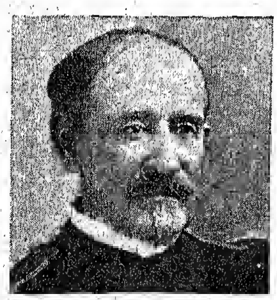
I. PHYSIOGRAPHY: P-312, S-226 map.
II. RESOURCES, INDUSTRIES, AND PRODUCTS: P-313, L-156, S-28, list P-312. Cork C-365.
III. CITIES: P-312. Lisbon (capital) L-156, P-312, P-314 picture; Porto P-312, P-313.
IV. POSSESSIONS: Angola and Mozambique A-42, M-294, E-139 map, C-331 map; Azores A-408; Cape Verde Islands C-81; Madeira M-18; Portuguese India I-43; Macão, Portuguese Guinea, St. Thomas and Principe, Portuguese Timor (Fact-Index).
V. PEOPLE AND CULTURE: P-312, P-313, P-314.
VI. HISTORY:
A. Early History and Establishment of Kingdom: P-314.
B. Exploration and Building of Vast Colonial Empire: P-314. Period of Commercial Supremacy P-312.
  a. Africa: Cape of Good Hope C-80, D-64, S-199; Cape Verde Islands C-81; Congo River C-330; Mozambique M-294.—Henry the Navigator H-280, A-38.
  b. The Far East: E-141, E-142*f*. Ceylon C-137; Japan J-191*a*; Java J-205; Malay Peninsula M-43.—Vasco da Gama G-3–4, A-38.
  c. Brazil: B-227–28.
C. Conquest by Spain, Independence, Loss of Important Colonies: P-314, E-142*f*.
D. Alliance with England Through Methuen Treaty: P-314.
E. Modern History, Republic Established: P-315, L-156.
F. Second World War: P-315.

Bibliography for Spain and Portugal

—Books for Younger Readers:
Atwater, C. N. Manoel (Longmans, 1940).
Brann, Esther. Lupe Goes to School (Macmillan, 1933).
Jordan, C. B. Discovering Christopher Columbus (Macmillan, 1932).
Newcomb, Covelle. Vagabond in Velvet (Longmans, 1942).
Palencia, Isabel de. Juan: Son of the Fisherman (Longmans, 1941).
Peck, A. M. and Meras, E. A. Spain in Europe and America (Harper, 1937).

—Books for Advanced Students and Teachers:
Chapman, C. E. History of Spain (Macmillan, 1937).
Hewes, A. D. Spice and the Devil's Cave (Knopf, 1930).
Irving, Washington. Alhambra (Macmillan).
Palencia, Isabel de. I Must Have Liberty (Longmans, 1940).
Paul, E. H. The Life and Death of a Spanish Town (Modern Library, 1942).
Starkie, W. F. Spanish Raggle-Taggle (Dutton, 1935).

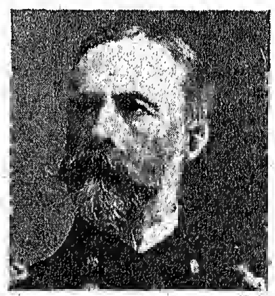
SPANISH-AMERICAN WAR (1898). The 114-day war with Spain in 1898 had far-reaching results, for almost without warning it made the United States an imperial power, with dependencies extending from Puerto Rico on the Caribbean Sea to the Philippine Islands on the edge of the China Sea. The war also accomplished its announced purpose of freeing Cuba from Spain. The spectacular voyage of the battleship *Oregon* from San Francisco through the Strait of Magellan to Cuban waters emphasized the need for the Panama Canal. The war opened a period in American history in which each year was to bring added obligations and anxieties respecting the rest of the world.



ADMIRAL SCHLEY

The occasion for the war came out of Cuba, where a revolt against Spain broke out in 1895. The Insurgents started a reign of terror against Loyalists, burning their homes and destroying their property in the fields. The Spanish army, under General Weyler, met terror with brutality, sweeping the people from whole provinces into great wire enclosures, and holding them there, as *reconcentrados*, in order to pacify the country. Hundreds of women and children, as well as men, sickened and starved in their prison camps.

The outrages were horrible enough, but they were exaggerated by unscrupulous "yellow" newspapers in New York and other cities. American opinion was led away from its usual unwillingness to interfere in the internal affairs of another country, and a widespread demand arose for forcible intervention to set Cuba free.



ADMIRAL SAMPSON

Perhaps President McKinley, who had seen one war and did not wish another, might have eased the situation for the Cubans; but on Feb. 15, 1898, the United States battleship *Maine* was destroyed in Havana harbor by an explosion. In 1911, when the hull was raised examination proved that the explosion was external, but probably the world will never know

whether the Spaniards or some Cuban patriots, seeking a cause for American intervention, were directly responsible. Some 260 men were lost with the *Maine.* The "yellow" papers charged that the explosion was due to Spanish treachery. The hope of peace was lessened by the publication of a private letter written by the Spanish minister in Washington, De Lome, with an insulting allusion to McKinley. Although Republican leaders did not want a war, McKinley finally yielded to the popular outcry ("Remember the *Maine!*") and recommended to Congress that the United States intervene with force to set Cuba free. Congress passed the appropriate resolutions on April 19.


LIEUTENANT HOBSON

A blockade of Cuba was ordered at once, in the hope of catching a Spanish fleet coming out from Spain. But the blockade was slow, and Admiral Cervera arrived safely at Santiago on May 19. After the discovery that he was inside the harbor, the blockade was tightened, but he made no effort to come out. His fleet was not fit to fight, and he had no wish to sacrifice his ships and men. Rear-Admiral William T. Sampson, in charge of America's Atlantic fleet, was not permitted to force a battle with Cervera, but he sent to Washington an appeal for an army to reduce the forts that protected Santiago harbor.

In the far-off Philippine Islands, of whose very existence few Americans were aware, a squadron of six ships commanded by Commodore George Dewey had already sailed into Manila Bay, and, on May 1, 1898, had destroyed the Spanish fleet that he found there (*See* Dewey, Admiral George).

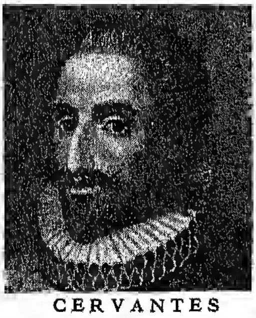
In response to Sampson's appeal, 16,000 men, mostly regular army troops, were assembled at Tampa, Fla., and sent on transports to Santiago. With this army went the First Volunteer Cavalry—a regiment raised by Leonard Wood and Theodore Roosevelt, and known as the "Rough Riders" because many of its men had been recruited from the cowboys of the Far West. The force, under Gen. William R. Shafter, lacked proper food, medicine, and supplies, for all of which Congress was primarily to blame, since Congress had not in time of peace provided a competent organization for military affairs. It was landed on the Cuban coast in June, and on July 1–3 it engaged the Spanish at Kettle (San Juan) Hill on the outskirts of the trenches of Santiago.

It was so successful on the first day that the Spanish authorities ordered Cervera to take his fleet to sea in order to avoid the humiliation of capture by an army. On Sunday morning, July 3, 1898, the American Atlantic squadron, still on blockade, saw the battleships emerge between the high bluffs at the mouth of the channel. In the resulting naval fight every Spanish ship was sunk or beached, with almost no loss to the American forces. The fighting of the war was over. Most of the 200,000 volunteers who answered the President's call never left the United States. An expedition to Porto Rico was stopped on the eve of battle by news of an armistice; and in the Philippines the army, in ignorance of the armistice, fought its only battle the day after it was signed. Santiago formally surrendered July 17.

Later in July, the Spanish government sought peace by negotiations through the French ambassador, and on Dec. 10, 1898, the treaty was signed at Paris. Spain relinquished authority over Cuba, and turned over to the United States Porto Rico, the Philippine Islands, and Guam. In return, the United States paid Spain $20,000,000 for government buildings erected by Spain in the colonies.

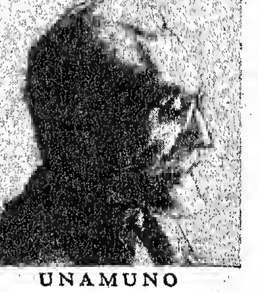
The SOFT SPEECH *and* VIGOROUS LITERATURE *of* SPAIN

SPANISH LITERATURE. Spain has been divided by mountains into isolated valleys, and by invasion and wars into hostile groups. The Pyrenees have severed the country from close contact with Europe. Naturally, the Spaniard has become individualistic, provincial, local, and conservative.


CERVANTES

The Romans gave him his language, but it was the Iberians, Jews, Celts, Vandals, Visigoths, and Arabs, as well, who gave him his character. It is this character—proud, dignified, mystic, gracious, elegant, and sometimes cruel—together with the isolation and wars of Spain, which have etched the traits of Spanish literature.

The language, an outgrowth of Latin, resulted in a less uniform speech in this divided country than its sister tongues, French and Italian. The literary tongue is Castilian, a dialect softened by Arabic. Catalonia has a language and a literature of its own.


UNAMUNO

The earliest known work in Spanish is 'El Cantar de Mío Cid' (Poem of the Cid), dating from 1140. The unknown writer left an epic poem crude in meter but full of the dignity and austerity of the hills of Spain. The "Cid" was Rodrigo Ruy Diaz de Bivar, who died in 1099. Though he had often helped Moslems against Christians, the poem presents him as a dauntless champion

of Christianity against the Moors, and leaves a graphic record of the life of the times.

Heroism and religion have long been the preoccupations of Spain, and many are the early religious and miracle-plays such as the 'El Auto de los reyes magos' (Mystery of the Magian Kings), a play of the Three Wise Men.

Spanish energies were sapped by eight centuries of struggle with the Moors, and the year 1492, when the Moors were expelled, saw the discovery of America, opening new outlets and interests to Spain. Little of the nation's vitality went into literature until the 17th century, the "golden age" of Spanish literature as it was of national glory.

WRITERS OF GAY COMEDIES

Lively dialogue and true Spanish humor are traits of the charming comedies, chiefly of Andalusian life, by the brothers, Serafín and Joaquín Álvarez Quintero.

In 1605 appeared the first part of 'Don Quixote', bringing fame to poverty-hounded Miguel de Cervantes Saavedra. Perhaps no book by a single author has been more widely read. Don Quixote on his spavined steed gave the final stroke to the false ideals of knight-errantry. Satire though it is, its most notable result was to project kindliness and human warmth into literature. (*See* Cervantes Saavedra, Miguel de.)

Two other attacks on hollow chivalry were made in Mateo Alemán's novels, 'Guzmán de Alfarache', and 'Atalaya de la vida umana' (The Watchtower of Human Life), the first of that purely Spanish invention, picaresque literature, dealing with the "picaro," or rogue.

Four great dramatists appear in this same period. The two most famous are Lope Félix de Vega Carpio and Pedro Calderón de la Barca, better known as Lope and Calderón. The prolific Lope wrote his first play at the age of 12, tossed off over 1,000 plays and many epic poems. His rapid improvisations lack finish or subtlety, but glow with genius, in disproof of the old saw "genius is the capacity for taking pains." Lope, like Shakespeare, abandoned stilted forms for human reality. Cervantes called him "a monster of naturalness."

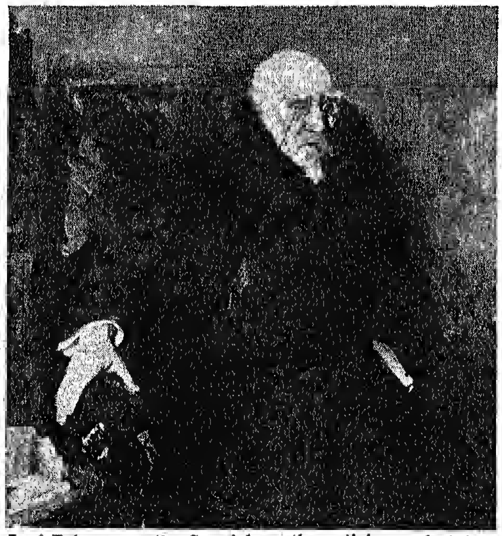
Calderón, on the other hand, might be called "a monster of ingenuity." At his best he surpasses Lope, but his style is as tiresomely lavish as baroque architecture, a mass of rhetoric and bombast. He is at his best in "cape-and-sword" plays such as 'La Dama duende' and 'Mañanas de abril y mayo'. His one great philosophical drama, 'La Vida es sueño' (Life is a Dream), retells an oriental story, 'The Awakened Sleeper'.

The third of the great dramatists, Gabriel Téllez, called Tirso de Molina, gained fame by dramatizing the old Don Juan legend in 'El Burlador de Sevilla y convidado de pietra', a play imitated by thousands.

The fourth dramatist is Juan Ruiz de Alarcón, a Mexican hunchback, student of Salamanca, and rich business man. Mocked for his deformity, he rebuked cruelty and other vices by presenting character types, a device adopted by Corneille and Molière.

When Spain's star declined as a nation, literature suffered a long eclipse, to recover somewhat in the 19th century. An outstanding novelist of the period is Benito Pérez Galdós, who wrote a brilliant series of historical novels. Pedro Antonio de Alarcón set the world laughing with his 'El Sombrero de tres picos' (The Three-Cornered Hat). An effective artist was José María de Pereda, who hated cities and the middle class, created fine peasant types, and preached patience and peace.

A FAVORITE OF THE NINETIES



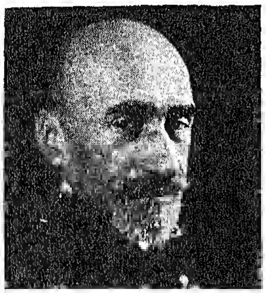
José Echegaray, the Spanish mathematician and statesman who turned playwright and ruled the stage in the 90's, is shown in a portrait by Sorolla.

First Spanish writer to win the Nobel prize was José Echegaray, whose play 'El gran Galeoto' had a great success in Europe and America. A skilled technician, wise in stagecraft, he ruled the theater from 1873 to the 90's, but modern criticism finds him over-ingenious and windy. Modernism in writing was brought to Spain by a Nicaraguan poet, Rubén Darío, famous overnight for his poem 'Azul'.

A great awakening came in 1898 with the war which, strangely enough, left Spaniards and Americans better friends than before. Americans were attracted to Spanish art. Spaniards, realizing their backwardness, resolved to redeem the nation from "españolismo," dull indifference toward everything not Spanish. Ángel Ganivet and Joaquín Costa led this movement of "the generation of 1898," rewarded in a new flowering of literature.


MADARIAGA

Ramón Pérez de Ayala has been called greatest of modern Spanish poets, with sensitive, melancholy Juan Ramón Jiménez perhaps second. King of the Spanish drama is Jacinto Benavente, winner of a Nobel prize in 1922. His tragedy of peasant life, 'La Malquerida' (The Passion Flower), was a tremendous American success in 1918. Delightful comedies were written by Serafín and Joaquín Álvarez Quintero, and delicate, poetic novels by another duo, Gregorio Martínez Sierra and María de la O Lejárraga, his talented wife.


BENAVENTE

Famous abroad for his timely novel 'Los cuatro jinetes del Apocalipsis' (The Four Horsemen of the Apocalypse), Vicente Blasco Ibañez nevertheless attained but a low literary standard. Pío Barója poured out novels in a forceful, formless cataract, and Ramón Maria del Valle-Inclán was a powerful, startling stylist. Another stylist, leading critic of Spain, was José Martínez Ruiz, called Azorín, corrective of Spanish fluency and figures of speech. Salvador de Madariaga, made first ambassador to the United States by the new Spanish republic, showed equal skill as poet and novelist.

Greatest intellectual force in Spain in recent years was Miguel de Unamuno, philosopher, poet, and novelist, who, like Madariaga, spent years in exile previous to the downfall of Alfonso XIII. Like the Socialists, he resisted the confining ideas of race and nation, not because they impede the action of groups but because they limit the individual. Individualism was strong in his most famous work, 'The Tragic Sense of Life', just as it has always been a vital trait of the Spaniards and their literature. The conflict between faith and reason, the essence of Unamuno's work, is at the root of Spanish philosophy.


IBAÑEZ

PROMINENT FIGURES IN SPANISH LITERATURE

'El Cantar de mío Cid' (Poem of the Cid), about 1140.

'El Auto de los reyes magos' (Mystery of the Magian Kings), 12th century.

Juan Manuel (1282–1347), short story writer—'El Conde Lucanor'.

Juan Ruiz (14th century), poet and prose fiction writer—'El Libro de buen amor'.

Gil Vicente (1470?–1536), dramatist—'Amadís de Gaula'; 'Ignez Pereira'.

Mateo Alemán (1547?–1614?), novelist—'Guzmán de Alfarache'.

Miguel de Cervantes Saavedra (1547–1616), novelist, dramatist—'Don Quixote', novel; 'La Numancia', play; 'Novelas exemplares', stories.

Luis de Argote y Góngora (1561–1627), poet—'Lloraba la niña'; 'Angélica y Medoro'; 'Soledades'.

Lope Félix de Vega Carpio (1562–1635), dramatist—'Los Tellos de Meneses'; 'Porfiar hasta morir'; 'El Acero de Madrid'; 'Las Bizarrias de Belisa'; 'La hermosa fea'; 'La Gatomaquia'.

Guillén de Castro (1569–1631), dramatist—'Las Mocedades del Cid'.

Juan Ruiz de Alarcón (1580?–1639), dramatist—'La Verdad sospechosa'; 'Las Paredes oyen'.

Francisco de Quevedo y Villegas (1580–1645), philosopher, poet, novelist—'Historia de la vida del Buscón', picaresque novel.

Pedro Calderón de la Barca (1600–1681), dramatist—'La Dama duende'; 'El Alcalde de Zalamea'; 'El Mágico prodigioso'; 'La Vida es sueño'; 'La Cena del rey Baltasar'.

Baltasar Gracian (1601–1658), novelist—'El Criticón'.

Diego de Torres Villarroel (1696–1770?), autobiographer—'Vida'.

Mariano José de Larra (1809–1837), satirist—'El pobrecito hablador', periodical written entirely by Larra.

Antonio García Gutiérrez (1813–1884), dramatist—'El Trovador', inspired opera 'Il Trovatore'.

Juan Valera (1824–1905), novelist—'Pepita Jiménez'.

José Echegaray (1833–1916), dramatist—'El Gran Galeoto'.

Pedro Antonio de Alarcón y Ariza (1833–1891), novelist—'El Sombrero de tres picos' (The Three-Cornered Hat).

José María de Pereda (1833–1906), novelist—'Sotileza'; 'Peñas arriba'.

Rosalia de Castro (1837–1885), poet—'Cantares gallegos'; 'En las orillas del Sar'.

Benito Pérez Galdós (1845–1920), novelist—'Doña Perfecta'; 'La Corte de Carlos IV'; 'Zaragoza'.

La Condesa Emilia Pardo Bazán (1852–1921), novelist—'Los Pazos de Ulloa'; 'La Madre naturaleza'.

Armando Palacio Valdés (1853–1938), novelist—'Marta y María'; 'José'; 'La Espuma'.

Miguel de Unamuno (1864–1936), philosopher, novelist, poet—'Niebla' (Mist), novel; 'Del sentimiento trágico de la vida en los hombres y en los pueblos' (The Tragic Sense of Life in Men and Peoples), philosophical treatise.

Jacinto Benavente (1866–), dramatist—'Gente conocida'; 'Señora ama'; 'La Malquerida'.

Rubén Darío (1867–1916), poet—'Azul'; 'Cantos de vida y esperanza'.

Pío Barója (1872–), novelist—'Camino de perfección'; 'La Busca'; 'Mala hierba'; 'Aurora roja'.

Vicente Blasco Ibañez (1867–1928), novelist—'Los cuatro jinetes del Apocalipsis' (The Four Horsemen of the Apocalypse); 'La Catedral'; 'Mare Nostrum'; 'Sangre y arena'.
Ramón Maria del Valle-Inclán (1870–1936), novelist—'Sonatas'; 'La Guerra carlista'; 'Cofre de sándalo'.
Joaquín (1873–) and Serafín (1871–1938) Álvarez Quintero, dramatists—'Los Galeotes'; 'El Centenario'.
José Martínez Ruiz ("Azorín") (1874–), critic and novelist—'Los Valores literarios', criticism; 'La Voluntad', novel; 'Los Hidalgos'; 'El Alma Castellana'.
Ramón Pérez de Ayala (1881–), poet and novelist—'El Sendero innumerable', poem; 'La Pata de la raposa', novel.
Juan Ramón Jiménez (1881–), poet—'Arias tristes'; 'Piedra y cielo'.
Gregorio Martínez Sierra (1881–) and his wife María de la O Lejárraga (1880–), poets, novelists, dramatists, under signature Martínez Sierra—'Flores de escarcha', verse; 'Tú eres la paz', novel; 'Canción de cuna', play.
Salvador de Madariaga (1886–), poet and novelist—'La Girafa sagrada', novel; 'Romances de Ciego', poem.

SPARROW. Sparrows are the plainly-colored members of the finch family, but their musical ability makes up for their lack of fine feathers. The males and females look much alike. In North America there are about 40 species, found nearly everywhere.

The song sparrow, which picks his home near water, has heavily streaked underparts and a conspicuous black spot centering his breast. One of the first suggestions of spring is the voice of this great soloist. In the woodland lives the reddish-brown fox sparrow, also a master musician. As you tramp along the road another sparrow darts from the weeds, and two white outer tail feathers mark him as the vesper sparrow. This six-inch bird of the plains and fields is famed for the appealing melody of his song. Other noted singers are the white-crowned and white-throated sparrows, whose names describe them.

The swamp sparrow is a bird of the marshes, where he mingles his simple lay with the music of the marsh wrens. The confiding chipping sparrow may place his neat hair-lined nest low in the bushes of your garden. In a high-pitched voice he trills *chippy, chippy, chippy* so fast you may mistake him for a fiddling cricket. The short-tailed grasshopper sparrow, about five and a half inches long, likes fields of daisies and clover. He is so named because his weak insect-like song recalls the grasshopper's chirp.

THE TREE SPARROW

A wedge of black spots his unstreaked breast; a rufous patch caps his head—by these marks you know the Tree Sparrow. In October he and his family pack up and leave Canada to spend the winter harvesting the season's crop of weed seeds in northern United States.

The prolific house sparrow, a hardy street urchin imported from Europe in 1851, is a weaver finch, not a true sparrow. He is disliked because of his untidy ways and his tendency to drive away more desirable birds.

Sparrows are summer residents throughout the United States and Canada, but most of them winter in the Gulf states. Their stout, conical bills are well adapted for seed-eating, but they also feed on insects. As a rule, weed seeds are their food, but the young consume many destructive insects.

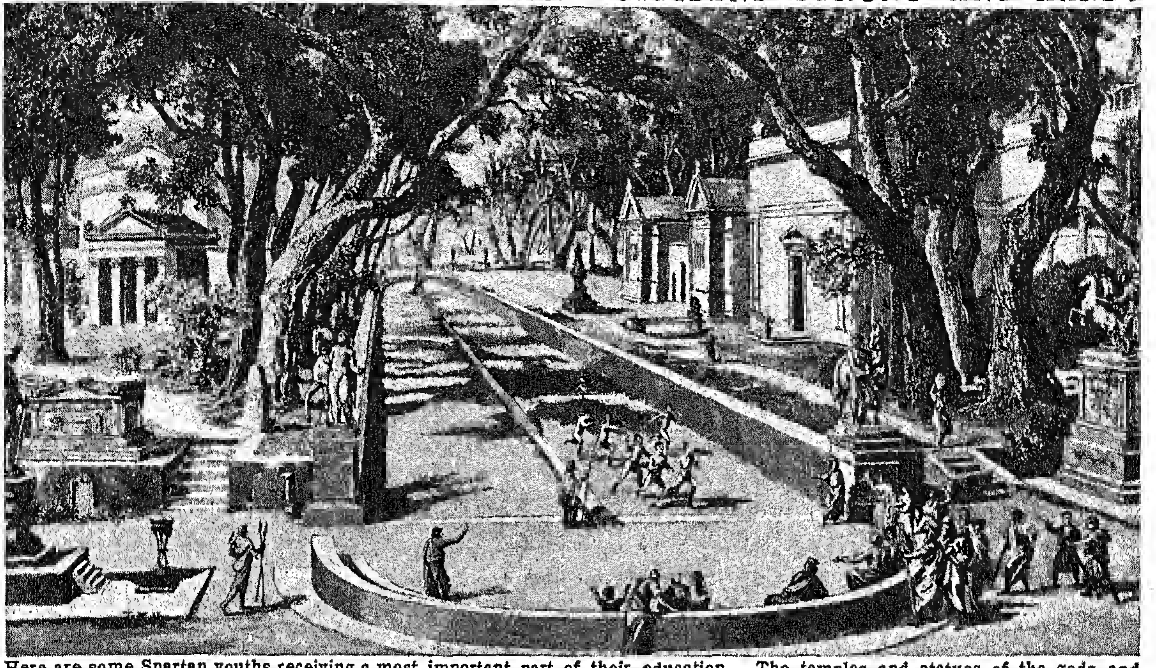
Sparrows belong to the family *Fringillidae*. Scientific name of song sparrow, *Melospiza melodia;* white-crowned sparrow, *Zonotrichia leucophrys;* vesper sparrow, *Pooecetes gramineus;* chipping sparrow, *Spizella passerina*. The house sparrow (*Passer domesticus domesticus*) belongs to the family *Ploceidae*.

SPARTA, GREECE. The great rival of Athens in ancient Greece was Sparta, whose vigorous race of iron-hearted warriors has given us the adjective "spartan." Sparta prided itself not on art or learning or splendid buildings, but on its valiant men who "served their city in the place of walls of bricks." And although Athens, with her beautiful temples and statues, her poetry and philosophy, dominated the intellectual life of the world, it was Sparta which in the end snatched from its cultured opponent political supremacy.

The Spartan government was founded on the principle that the life of every individual from the moment of birth belonged absolutely to the state. The elders of the city inspected the newborn infants and ordered the weak and unhealthy to be carried to a near-by chasm and left to die. By this practise Sparta made sure that only those who were physically fit should survive.

The children who were allowed to live were brought up under an iron rule. At the age of seven the boys were removed from the control of their parents and organized into small bands over which the strongest and most courageous were made captains. They slept in public dormitories upon hard beds of rushes; they ate together of black broth and other coarse and meager fare; and they wore only the simplest and scantiest clothing. They were drilled each day in gymnastic and military exercises until their muscles were like iron and their willpower like steel. They were taught that retreat in battle, or surrender, was a disgrace. One mother's injunction to her son was: "Come back with your shield or upon it." They were taught to endure

WHERE SPARTA MADE HER YOUNG CITIZENS STRONG AND HARDY



Here are some Spartan youths receiving a most important part of their education. The temples and statues of the gods, and especially of the Great Twin Brethren Castor and Pollux—Spartans and athletes as well as gods—looked over it, for nothing, according to Spartan view, was more worthy of divine approval than the training of brave and hardy citizens.

pain and hardship without complaint, and to obey orders absolutely and without question.

They were allowed to feel the pinch of hunger and encouraged to supplement their fare by pilfering food for themselves. This was not done to cultivate dishonesty, but to develop shrewdness and enterprise. If they were caught, they were whipped for their awkwardness. Once, it is said, a Spartan boy, having stolen a young fox for his dinner, allowed the animal, which was hidden under his cloak, to gnaw out his vitals rather than to betray his theft by crying out. The girls were educated in classes under a similar system, but with less rigor.

Discipline grew even more rigorous when the boys reached manhood. All Spartan citizens between the ages of 20 and 60 served in the army, and though allowed to marry, all had to belong to a men's dining club and eat and sleep in the public barracks. They were forbidden to possess gold and silver and their money consisted only of iron bars. War-songs were their only music, and their literary education was slight. No luxury was allowed even in the use of words. They spoke shortly and to the point, in the manner which we have come to call "laconic," from Laconia, the district of which Sparta was the capital (also called Lacedaemon).

The Three Classes in Sparta

There were three classes of inhabitants in Laconia. The Spartan citizens (*Spartiates*), who lived in the city itself and who alone had a voice in the government, devoted their entire time to military training. The *Perioeci*, or "dwellers-round," who lived in the surrounding villages, were free, but had no political rights. They were the tradesmen and mechanics—occupations not allowed to the Spartans. The *Helots* were serfs, little better than slaves, bound to the farms and forced to cultivate the soil for the citizens, their masters, who owned the land. These Helots whose marriages and children were not so strictly controlled by the state, were the most numerous class and bitterly hated their masters. Only the amazing organization and splendid fighting powers of the Spartan state could keep them under control.

Two Kings to Check Each Other

Another strange feature of Sparta was that the government was headed by two kings, who ruled jointly, serving as high priests, as well as leaders in war. Each king acted as a check on the other. There was a sort of cabinet composed of five *ephors* or overseers, who exercised a general guardianship over law and custom and came in later times to have greater power than the kings. The legislative power was vested in the assembly of Spartan citizens and in a senate or council of elders, chosen from the men who had passed the age of 60.

The Spartan armies, although usually quite small, were all but irresistible. Each citizen soldier was inspired by the resolve to win or die. The Spartan mother, when she gave her son his shield, used to say: "Bring back this shield yourself or be brought back upon it," referring to the manner in which the dead were carried from the battlefield.

The Spartan constitution is said to have been founded by Lycurgus (*see* Lycurgus). Under the

rigid discipline of its laws, Sparta extended its conquests over the neighboring states until it gained control of most of the Peloponnesus—the peninsula forming the southern half of Greece.

Sparta's prowess naturally brought rivalry with Athens, the leader of the northern states and for a time of all Greece. This rivalry culminated in the Peloponnesian War (431–404 B.C.) which resulted in Athens' ruin and Sparta's supremacy. But the tyranny of the Spartans aroused hatred and rebellion, and the jealous limitations on citizenship gradually cut down the number of the specially trained warriors until only a few hundred remained. After about 30 years of Spartan domination, the Thebans under Epaminondas defeated Sparta and ended her power. With the rest of Greece, Sparta was soon conquered by the Macedonians, and finally became a part of the Roman Empire. (*See* Greece.)

The modern town of Sparta, built after the Greek War of Independence in 1834, occupies part of the ancient site, near the river Iri (the ancient Eurotas) and about 15 miles from the Gulf of Messenia. Present population, about 5,800.

SPARTACUS (died 71 B.C.). For many years the name of the Thracian slave Spartacus was terrible to the ears of the old Romans; for it reminded them of the danger that constantly menaced the very existence of their state, the danger of an uprising of the enormous slave population that might wipe out the Roman nation at a blow. Scholars have calculated that for every freeman in ancient Italy there were three slaves. If these unhappy men, goaded by the brutal treatment they received as household and plantation laborers, had once united under capable leadership, nothing could have withstood them.

There were many slave uprisings in the history of Rome, but the most formidable was that headed by Spartacus in 73 B.C. Escaping from the school of gladiators at Capua, he fled to Mount Vesuvius, where he collected an army of runaway slaves like himself. For two years he terrorized Italy, defeating army after army sent against him from Rome, and laying the land waste from the foot of the Alps to the southern tip of the peninsula. But the insurrection was finally crushed, Spartacus was slain, and 6,000 of his followers were crucified along the Appian Way leading to Rome.

Probably the children of today are not so familiar with Elijah Kellogg's imaginary address, 'Spartacus to the Gladiators at Capua', as were their fathers, many of whom have stood on the schoolroom platform on Friday afternoons and recited stirring lines concluding: "If ye are men—follow me! . . . if we must fight, let us fight for ourselves! If we must slaughter, let us slaughter our oppressors! If we must die, let it be under the clear sky, by the bright waters, in noble, honorable battle!"

At the close of the World War of 1914–18, the name "Spartacans" was applied to the extreme radical wing of the German Socialists, from the fact that its leader, Karl Liebknecht, had written under the pen name of "Spartacus" while held prisoner by the German government. The origin of the group is found in the opposition of the extreme left to the war, which led to a split in the Socialist party and the formation of the Independent party—Spartacans. After the revolution of 1918 and the overthrow of the Kaiser, the party became even more radical.

SPECTACLES. Few persons have perfect vision. The eye is so delicate an instrument that the slightest irregularity in its structure produces serious defects of vision (*see* Eye). Many of these errors may be corrected by wearing spectacles, which are lenses so ground as to counteract the fault in structure.

To find out just what lenses your eyes require, the oculist (eye specialist) makes various tests. He asks you to read lines of letters of various sizes from a chart and to describe various pictures and combinations of lines that he shows you; he examines the retina itself by the aid of a strong light and a magnifying glass. Thus he finds out not only how far your vision differs from the normal but also the cause of the trouble. In some cases the muscles which converge the eyes are weak; the eyes themselves may be nearsighted; they may be far-sighted (all eyes become farther sighted with advancing years); they may be so shaped as to give distorted images; very frequently the two eyes differ. It is comparatively easy to find out how far the vision is from "20/20" or normal, but much skill and experience are required to determine the exact nature of the defect. That is why it is well worth the fee to have the eyes properly tested by a specialist. Glasses bought of an itinerant peddler or made after inadequate examination may ruin the sight.

The oculist writes a prescription for a lens for each eye. The optician grinds, from plain lenses of specially prepared optical glass, lenses with the prescribed curves. Concave lenses are used to correct short sight, convex lenses for far sight; prisms, where the eyes turn in or out too much; segments of cylinders, for astigmatism or irregular curvature of the cornea; and endless combinations and modifications of these forms for complicated conditions.

Then the optician fits the ground and polished lenses into frames, adjusting each lens so that its center will come at exactly the right point in front of the pupil, and tilting it to give just the right angle for reading or distant vision. Glasses with side bars or bows to pass over the ears are specifically designated "spectacles," while those which clip to the nose are called "eye-glasses" or "pince-nez." Single eye-glasses or "monocles" and glasses mounted on a handle ("lorgnettes") are also used. Plain colored glasses are used to protect from glare and dust.

Spectacles were invented late in the 13th century, perhaps by Roger Bacon (*see* Bacon, Roger). They were crude at first and were little improved for centuries. Bifocal lenses were invented by Benjamin Franklin. These have a small lens for near vision set into a larger lens for distant vision. The latest development is the manufacture of *contact lenses*. They are made of glass or plastic and fit directly over the eyeball under the lids so as to be virtually invisible.

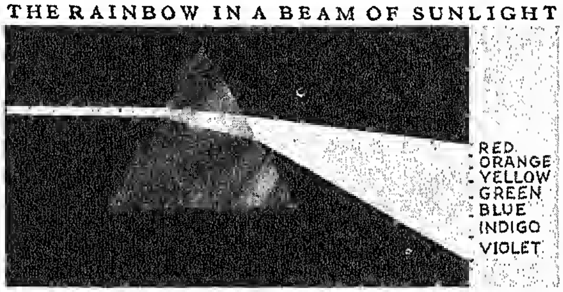
WHAT *the* RAINBOW TELLS *the* SCIENTIST

How Its Little Brothers Reveal the Nature of Color and What the Sun and Stars Are Made of—the Spectroscope with Which We Read the Message and Learn These Distant Secrets

SPECTRUM AND SPECTROSCOPE. The rainbow had puzzled men for centuries, but not until the time of Charles II of England was a valid explanation offered for it. In 1672 Sir Isaac Newton, while trying to eliminate the color fringes (*chromatic aberration*) given by the telescopic lenses of his time, decided that the fault might lie in the character of light itself. So he started to study how light formed colors, using glass prisms as analyzers.

For one thing, he showed that if a small beam of sunlight be admitted to a darkened room and passed through a prism, it produced a band of colors exactly like those of the rainbow, ranging from red through yellow, green, and blue to indigo and violet. He then passed each of these colors through other prisms, and found that they did not change; but when the whole band of colored light was passed through a prism in reverse position to the first, it became white sunlight again. From this he reasoned that white light really was a mixture of colored lights, and that each color was bent by a different amount when it passed through the prism, so that it would stand out separately and be visible (*see* Color). Such a band of colored light is called a spectrum, and the rainbow is an example (*see* Rainbow).

THE RAINBOW IN A BEAM OF SUNLIGHT



Here is a beam of white light broken up by a glass prism into the colors of the solar spectrum—red, orange, yellow, green, blue, indigo, and violet.

Emission and Absorption Spectra

Spectroscopic separation of light into its colors is called dispersion, and is accomplished by *refraction* produced by the prism. While refraction is explained in the article on Light, it may be said here that the rays for color bend a different amount on passing through a glass prism, red being bent least and violet most, as the accompanying picture shows. Moreover, for any given prism, the amount of bending for each color is constant—that is, each color always would fall in exactly the same place on a screen, so that its position is sufficient to identify it.

A spectrum produced as described is *continuous*—that is, the colors run smoothly into each other. However, if light be admitted to the analyzing prism through a narrow slit and a concentrating lens, the colors concentrate into bright lines with gaps between. This is called a *bright-line* spectrum, and both the bright-line and continuous types are called *emission* spectra, in contrast with the *absorption* type.

At the start of the 19th century an English chemist and physicist, William H. Wollaston (1766–1828) noticed that the continuous spectrum given by sunlight shining through a slit was crossed by numerous fine dark lines. The first detailed study of these lines was made by Joseph von Fraunhofer (1787–1826), a German optician. He charted more than 700 of them, without being able to explain them; but in his honor they are called *Fraunhofer lines.*

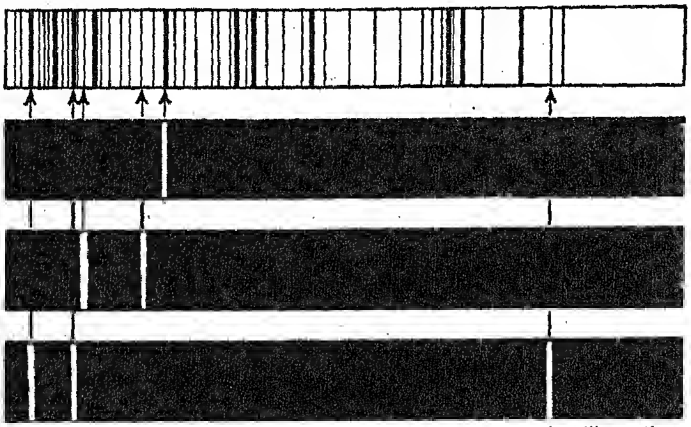
The mystery of these lines was solved by Robert Bunsen (1811–1899) and Gustav Kirchhoff (1824–1887). With an improved form of spectroscope, or instrument for producing spectra, they studied the spectra produced by vaporizing substances in the flame of the non-luminous burner which Bunsen had invented. They had recognized many bright lines that came invariably in the same places in the spectrum, when certain substances were heated to incandescence. Now they noticed that when such light was passed through a hot vapor containing the same substances, not as hot as the first, the bright lines were replaced by dark ones occupying the same positions. This meant that the second vapor had absorbed the characteristic light coming from the first. This result, announced with other findings in 1859, is known as *Kirchhoff's law*, which states that a glowing gas absorbs from the rays given by a hotter light source those rays which the gas itself sends forth.

They also noticed that both classes of lines—bright and dark—were strictly characteristic of the different chemical elements. Thus, incandescent sodium *always* gives certain yellow lines, near the middle of the spectrum, and *no other element* gives these lines. Hence, when these lines appear, sodium must be present in the incandescent substance. If the lines are bright, the light has come direct from the incandescent sodium. If they are dark, the light has passed, somewhere along its path, through an absorbing vapor containing incandescent sodium. Other elements likewise have their characteristic lines, which identify them. Amazingly minute quantities of an element are sufficient to make its lines appear.

Analyzing the Sun

These discoveries not only explained the Fraunhofer lines in the spectrum of sunlight, but made it possible to determine what chemical elements the sun contained. The absorption necessary to produce the dark lines was considered as taking place in the outer layers of incandescent gas surrounding the sun. For

HOW THE SPECTROSCOPE IDENTIFIES ELEMENTS



At the top is the "dark line" spectrum of sunlight, and the other illustrations show how the presence of certain chemical elements in the sun is made known. Each element gives a characteristic assortment of bright lines, such as shown (top to bottom) for sodium, lithium, and potassium. When lines corresponding to those in these spectra are present in the spectrum given by a sun or star, we know that these elements are present in it.

"analysis" of the sun, the dark lines could be compared with the bright-line spectra of different elements produced in the laboratory. Whenever they corresponded, scientists could be sure that the element existed in the sun. Stars likewise could be "analyzed" as to chemical contents by this method.

In order to carry out this work thoroughly, scientists have obtained spectra corresponding to the different elements, and have measured and charted every line. When they wish to learn the composition of a star, they photograph its spectrum, and then check the lines against these charts for the elements. A notable triumph of the method was the discovery of helium. In 1868, P. J. C. Janssen (1824–1907), a French astronomer, and the English astronomer, Sir Norman Lockyer (1836–1920), independently discovered lines in the solar spectrum which could not be identified with the charted lines of any known element. Lockyer interpreted this to mean that an element unknown to us existed in the sun, and named it helium, after *helios*, the Greek word for sun. Then in 1895 Sir William Ramsay (1852–1916) found that the Norwegian mineral *cleveite*, when heated, gave off minute quantities of a light gas which he identified as helium by means of its spectrum. (*See* Helium.)

Measuring Light Waves in Angstrom Units

Wave-lengths are measured in various units, but the one commonly used in spectroscopic work is the Angstrom unit. This is one of the special units which science has accepted, as a means of avoiding the excessively long decimal fractions which would be needed to express wave-lengths as short as those of light, if measured in inches or centimeters. The units commonly used are the *millimicron*, denoted by the symbol $\mu\mu$ and equaling one-millionth of a millimeter; and the Angstrom unit (A or A.U.), one ten-millionth of a millimeter. For example, violet light has a wave-length of 410 millimicrons, or 4,100 Angstrom units. The following table gives the wave-lengths which fall approximately in the center of each of the colored regions in visible light:

	$\mu\mu$	A.U.
Violet	410	4,100
Blue	470	4,700
Green	520	5,200
Yellow	570	5,700
Orange	620	6,200
Red	710	7,100

The huge numbers needed to express the frequencies corresponding to the various wave-lengths of light (*see* Radiation) are simplified by writing 1,000 as 10^3, 1,000,000 as 10^6, and so on, each higher value of the exponent, as the smaller numbers are called, meaning an additional zero added to the 10.

Since the color of light is determined by its wave-length, this means that the shorter the wave-length, the more the light is bent by passage through a given prism. Thus the wave-length (and therefore the frequency) of the vibration causing the wave can be judged from the amount of bending given by the prism, which can be learned in turn by the position of the line in question when the spectrum falls on a screen or photographic plate.

The principal parts of a modern prism spectroscope are a *collimator*, or tube with a slit at one end to admit the light, and a lens at the other to concentrate it. This collimator directs the light on an upright prism. There it is dispersed and then falls upon the object glass of a telescope, which sharpens the image for the observer. By moving the telescope along a scale, the amount of dispersion for any line can be determined. Sometimes a train of prisms is employed to increase the dispersion. When the observer's eyepiece is replaced by a camera to photograph the lines, the instrument is called a *spectrograph*.

Diffraction and Echelon Spectroscopes

A more powerful type of spectroscope is one using a diffraction grating, invented by Fraunhofer in 1821, and made by twisting a fine wire about two tiny screws. With it he measured the wave-lengths of light with surprising precision. The modern precision grating consists of a plate of metal or speculum glass upon which fine lines, equidistant and parallel, have been ruled. Among the finest of these are the gratings made by H. A. Rowland, who invented a machine to rule the entire grating automatically, etching from 14,000 to 20,000 lines to the inch. By means of such a grating, made on a concave surface, Rowland secured a spectrum band of sunlight more than 20 feet long. The grating uses a special application of the interference phenomenon described in the article on Light.

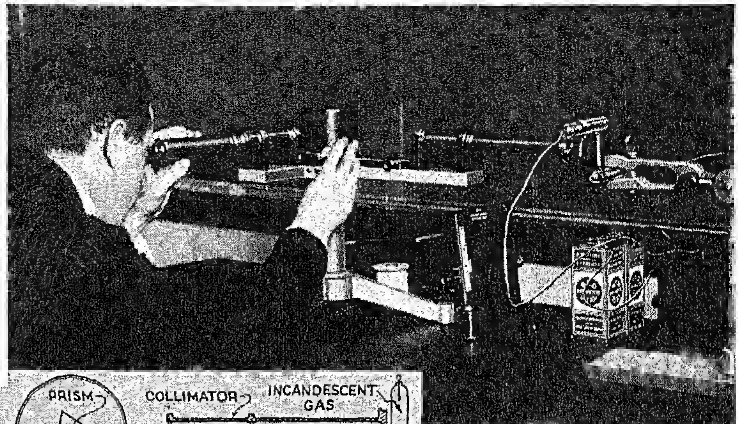
A more efficient type of grating called the *echelon* was invented by the late A. A. Michelson. Instead of ruling lines on speculum glass, Michelson placed plates of glass one on top of another, each projecting a bit beyond its neighbor, and thus obtained a wonderfully

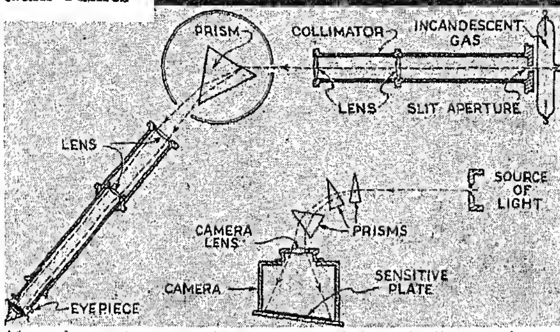
accurate diffracting surface, which is particularly useful in spreading apart "double" lines.

Motion, Temperature, Magnetism

In addition to revealing the chemical constitution of stars, the spectroscope can also tell the astronomer whether a star is moving toward or away from the earth, by means of a phenomenon known as the *Doppler effect* (*see* Sound). Everyone has noticed how the whistle of an approaching locomotive rises to a shrill note as it approaches, then drops to a lower and lower tone as the train rushes away. This happens because when the train approaches, its whistle is nearer each time a sound wave is emitted, successive waves reach us a little more quickly, and therefore have a higher pitch. Similarly, when the train is receding the waves are dragged out and the pitch of the whistle is lowered.

USING THE PRISM TYPE SPECTROSCOPE





Above is an observer using a "constant deviation" type of spectroscope, while the drawings below show the principles of construction used in the ordinary prism instrument, together with the way a camera can be substituted for the observer's telescope to form a spectrograph.

Similarly, when a star is traveling toward the earth, each light wave is shortened a little, and consequently the lines shift their position toward the violet end of the star's spectrum. When the star is moving away from the earth, the wave-lengths are lengthened somewhat and the lines in the spectrum shift a little toward the red end. The amount of shift reveals the speed of the star's motion; but since light travels at the tremendous speed of 186,270 miles per second, the star must be traveling at a very great speed to create a noticeable effect.

Temperature and pressure have certain effects on spectra, and thus reveal the approximate temperature of stars, and even measure the pressure of gases on the sun and other distant bodies.

Another marvelous revelation of the spectroscope is the connection between magnetism and light. The Dutch physicist, Pieter Zeeman (born 1865) discovered that when light passed through the field of a strong electromagnet, the lines in the resulting spectrum were split up into two or more lines. This influence of magnetism on light, named the *Zeeman effect* after its discoverer, has proved valuable in the detection and measurement of magnetism in the sun.

The Great Electromagnetic Spectrum

The little rainbow we have been talking about is known as the *visible spectrum;* but since all the various shades of color we can see are caused by waves of varying length and frequency, it must be possible that there are other waves or vibrations which we cannot detect with the human eye. This is the case, for all the known waves form a long spectrum of which only a very small portion is visible to us. The various waves, the effects they produce, and methods of studying them are told in the article on Radiation.

Spectra and the Nature of Matter

Study of the lines in various spectra has done much to help build the modern theory of matter (*see* Atoms and Electrons). Soon after Bunsen and Kirchhoff developed the use of spectral lines as a means of chemical analysis, men thought that the various lines were given off by atoms vibrating at different rates under the stimulus of heat, the faster vibrations giving the shorter waves that caused lines to appear toward the violet end of the spectrum. In 1885 Balmer found that the various rates of vibration in a mass of glowing hydrogen bore a simple mathematical relation to each other, indicating that some one type of "mechanism" was at work at varying rates, within the hydrogen atom, giving off the different wave-lengths; but he could not guess what this "mechanism" might be. J. R. Rydberg (1854–1919) extended knowledge of this subject, and developed a formula named for him which described many more observed relations; but he came no nearer than Balmer to learning what it was within the atom which vibrated. The answer to this problem came in 1913 from Niels Bohr of Copenhagen.

Bohr's theory, built to a considerable extent upon knowledge developed from the study of radioactivity (*see* Radium and Radioactivity) held that the hydrogen atom consisted of an electron revolving like a planet around a central nucleus or "sun." Bohr believed further that as an atom absorbed energy, as by being heated, this orbit would enlarge by definite amounts, each enlargement representing the

absorption of one *quantum* of energy. When energy was emitted, as in the form of light, the electron would fall into inner orbits, by steps, and the frequency of the light would depend upon how many orbits were traversed. If the electron fell inward by one orbit, the "energy splash" resulting from this would travel outward as light of a certain frequency. If it fell inward two orbits, or if the electron in some other atom did this, light of a different frequency would go forth; and the collection of lines given by hydrogen in a spectroscope sums up these actions taking place in all the hydrogen atoms present. Furthermore, by using Planck's constant (the fundamental measurement of a quantum) and electrical factors in a formula of the Rydberg type, Bohr was able to reduce his whole explanation to terms of electrical force. Thus the spectrum of hydrogen stood explained as the product of electronic forces within the atom, and the spectroscope became useful for studying the structure of matter.

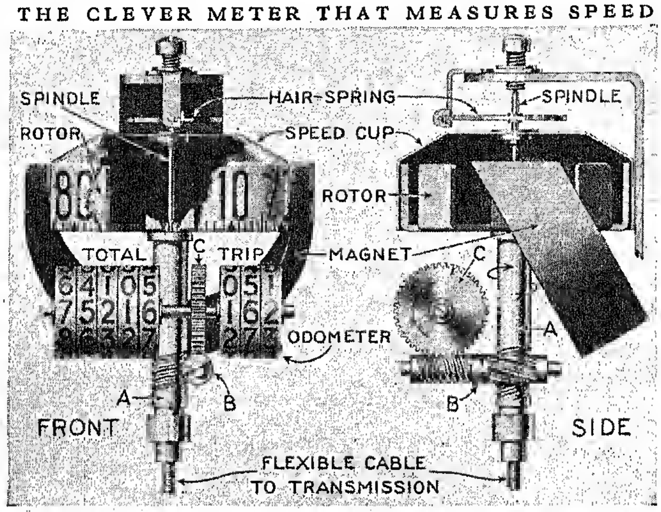
Obtaining Spectra with X-Rays

This type of work developed rapidly mostly because of the discoveries that X-rays could be made to give spectra just as light did. This was done by causing a beam of X-rays to fall slantwise upon the surface of a crystal. Since the space between the layers composing the crystal amounted to the "thickness" of only one or two atoms, this gave openings fine enough to diffract the short waves of the X-rays. Spectra, characteristic of the crystal used, resulted and could be photographed.

Within a year, an astonishing discovery followed. In 1913 and 1914, the young English physicist H. G. J. Moseley (1887–1915) announced the discovery of far-reaching relations among X-rays of various wavelengths, produced from the surface of different metals by the impact of electrons. Measured by methods similar to those used by Balmer for the visible spectrum of hydrogen, each metal, he found, gave certain groups of X-ray lines, corresponding to certain frequencies of electronic vibration; and the frequencies, passing upward through the scale of atomic weights, bore such simple mathematical relations that they were evidently due to simple increases in the number of planetary electrons in the atoms of the metals. Thus he was able to assign each atom an "atomic number" instead of an atomic weight, and thereby clear up many troublesome points about the relations of the elements (*see* Chemistry).

SPEEDOMETER. A number of devices for indicating the speed at which vehicles travel have been produced, perhaps the first being a speedometer which used a small fly-ball "governor" (*see* Steam Engine) which was linked up to a pointer mechanism. Such instruments are still made, but the magnetic type is the most popular. Several other types have been used, but are now no longer manufactured in the United States.

THE CLEVER METER THAT MEASURES SPEED



These diagrams show the operating principle of a popular American speedometer. Gearing in the car's transmission drives a shaft A through a flexible cable. A rotor on the top of A turns inside an aluminum cup carried on delicate bearings at each end of the spindle. The poles of a magnet just clear the outside of the cup. As the rotor turns, it distorts the magnet's field and sets up eddy currents in the cup varying in strength as the speed of the rotor changes. The varying eddy currents thus drag the cup around to a greater or lesser degree as the car's speed varies, and the correct figure for the speed shows through the aperture on the dashboard, at the point where the front view has been cut away. The operation of the mileage register, an entirely separate mechanism, is explained in the text.

The type pictured here is a widely used form. The operation of the speed-indicating part is described in the legend below the picture. The mileage-registering portion, which is substantially the same in all speedometers, works on the following principle:

The shaft A is turned a definite number of times when the machine travels one mile or one kilometer. We are not concerned here with how *fast* it turns. That is taken care of by the ingenious speed-indicating mechanism. If, for example, shaft A turns 1,500 times per mile or kilometer, it can be geared down through the worm gearing on B and C so that the wheel C will turn one revolution per mile or per kilometer, if the metric system is used.

The "total" group at the left and the "trip" at the right are both operated from wheel C. By means of a peculiar intermittent movement (omitted for the sake of simplicity) each number wheel must make one *complete* turn in order to advance the wheel to its left $\frac{1}{10}$ of a turn. If C turns once per mile, the first wheel in the total group will then turn so that it indicates one more mile. It in turn passes on every complete turn to its nearest neighbor to the left, which turns $\frac{1}{10}$ turn, and so for all the group. The highest number is thus 99,999. One more turn of C will bring all the wheels back to zero. The trip indicator, which can be reset to any desired figure, contains a *tenths* wheel at the extreme right. The operation resembles that of the total group. Popular in Europe is a *chronometric* type, in which a clock mechanism controls a counting device, calibrated to show speeds.

SPELLING. A great deal has been said about the difficulties of English spelling—much of which is not true. Learning to spell, of course, like everything else worth while, requires effort. But it need not be a bugaboo. Everyone can learn to spell if he goes about it in the right way.

Many have said that English is not a phonetic language, that is, it is not spelled as it is pronounced. Let us look into this statement. Investigation shows that some 22 per cent of the words in common use are non-phonetic, but that leaves 78 per cent that are spelled as they sound and are pronounced as they look. An authority on word study calls attention to the fact that "six of every seven syllables of our language are phonetic." Such difficulties as there are, then, must lie in the 22 per cent non-phonetic words, and with the one syllable out of seven.

Now we might make a list of non-phonetic words (words that look one way and sound another), so that we would not have to waste our time on words that are easy to spell. But to make such a list is not so simple as it might appear. For in that list we want only the words that we actually *use*. Each of us has three vocabularies: one for reading, one for writing, and one for speaking. The first is decidedly the largest. We understand in our reading many more words than we use. It has been estimated that the average person can read and understand between 8,000 and 10,000 words. Our writing vocabulary is not more than half as large; from 4,000 to 5,000 words are enough for all the writing we are likely to do. Oddly enough, though most of us speak many hundreds of words for each one that we write, the actual number of different words we use in speech is small, not more than 700 on the average. It is said that the average talker makes only 43 words do duty for half his ordinary conversation, using these 43 words over and over again. They are: and, be, have, it, the, to, will, you, about, all, as, at, but, can, come, day, dear, for, get, go, hear, if, in, me, much, not, on, say, she, so, that, these, this, though, time, we, with, write, your, her, one, of, by. What a difference between the ordinary person and the scholar! Woodrow Wilson used, it has been found, 6,200 different words in 75 of his speeches, but at least 60,000 in his writings.

To compile a scientific spelling list we evidently need to separate our writing from our speaking vocabulary, or, in other words, to find out just what words we use in writing. Elaborate investigations have been made to discover what are the common words in the writing of school children and of adults. The results of these investigations appear in the Jones list, the Thorndike list, the Ayres scale, the Iowa scale, the Commonwealth list, and several more, giving us the "commonest words," grouped as the "first thousand," "second thousand," and so on up to 10,000. While no one of the several investigations has given us a list which we may regard as final, a composite list made up of the words that are common to a majority of these lists and scales may be accepted as a writing vocabulary approximating that used by the majority of people.

Some of the investigators have carried on tests to determine the relative spelling difficulty of the "commonest words," and have made groupings to indicate the school grades in which they should be learned. The following list of 100 is widely cited as the most difficult of those in ordinary use:

which	writing	ready	choose	very
their	heard	forty	tired	none
there	does	hour	grammar	week
separate	once	trouble	minute	often
don't	would	among	any	whole
meant	can't	busy	much	won't
business	sure	built	beginning	cough
many	loose	color	blue	piece
friend	lose	making	though	raise
some	Wednesday	dear	coming	ache
been	country	guess	early	read
since	February	says	instead	said
used	know	having	easy	hoarse
always	could	just	through	shoes
where	seems	doctor	every	tonight
women	Tuesday	whether	they	wrote
done	wear	believe	half	enough
hear	answer	knew	break	truly
here	two	laid	buy	sugar
write	too	tear	again	straight

An examination of these words shows that one-third of them are *homophones* (words that are sounded alike but spelled differently, such as, *there, their; two, too*). It is obvious that we cannot spell any homophonous word until we know which one of the pair or group it is; that is, we must know its meaning.

The other difficulties in English spelling are due chiefly to the confusion in the formative days of the language between the phonetic standards of Anglo-Saxon and Norman-French; in part to the retention of old spellings after pronunciations had changed; to the introduction of new spellings based on mistaken analogies and etymologies; and to the borrowing by English from every other language.

It is economy of time to learn the spelling, pronunciation, meaning, and use of a word all at the same time. One of the serious mistakes of schools in the past was that they required pupils to spell words which were altogether beyond their understanding. The practise of the modern school is different.

The first step in seeking to know a word is to *see* it exactly. Much, perhaps most, of misspelling is due to *half*-seeing words. The second step is to pronounce the word precisely as it should be pronounced. If you say the word correctly, you will not write *prespiration* for *perspiration*, nor *suprised* for *surprised.* You must form two images of the word—the visual (the *look* of it) and the auditory (the *sound* of it)—and these two images must be closely associated in your mind. Next, center your attention on the critical point in its spelling by asking yourself, "What is the particular thing to remember about the form of this word?" The only difficult point about the word *thumb* is the silent *b* at the end. Fix your mind on that, connecting it with such words as *climb, comb,*

A YARDSTICK FOR MEASURING YOUR

A	B	C	D	E	F	G	H	I	J	K	L	M
99	98	96	94	92	88	84	79	73	66	58	50	←SECOND GRADE
↑ SECOND GRADE	THIRD GRADE→	100	99	98	96	94	92	88	84	79	73	66
				FOURTH GRADE→	100	99	98	96	94	92	88	84
						FIFTH GRADE→	100	99	98	96	94	92
								SIXTH GRADE→	100	99	98	96
										SEVENTH GRADE→	100	99
												EIGHTH GRADE→
me do	and go at on	a it is she can see run	the in so no now man ten bed top	he you will we an my up last not us am good little ago old bad red	of be but this all your out time may into him today look did like six boy book	by have are had over must make school street say come hand ring live kill late let big mother three land cold hot hat child ice play sea	day eat sit lot box belong door yes low soft stand yard bring tell five belt law ask just way get home much call long love then house year to I as send one bee some if how her them other baby well about men for ran was that his fed toy	nine face miss ride tree sick got north white spent foot blow block spring river plant cut song winter stone free lake page nice end fall feet went back away paper put each soon came Sunday show Monday yet find give new letter take Mr. after thing what than its very or thank dear west sold told best form far gave alike add	seven forgot happy noon think sister cost card south deep inside blue post town stay grand outside dark band game boat rest east son help hard race cover firm ago gold read fine cannot May line left ship train saw pay large near down why bill want girl part still place report never found side kind life here car word every under most made said work our more when from wind print air fill along lost name room hope same glad with mine	became brother rain keep start mail eye glass party upon two they would any could should city only where week first sent mile seem even without afternoon Friday hour wife state July head story open short lady reach better water round cost price become class horse care try move delay pound behind around burn camp bear clear clean spelt poor finish hurt maybe across tonight tenth sir those club seen felt full fail set stamp light coming cent night pass shut easy	catch black warm unless clothing began able gone suit track watch dash fell fight buy step walk grant soap news small war summer above express turn lesson half father anything table high talk June right date road March next indeed four herself power wish because world country meet another trip list people ever held church once own before know were dead leave early close flower nothing ground feed such many morning however mind shall alone order third push point within done body	trust extra dress beside teach happen begun collect file provide sight stood fix hem goes hold drill army pretty stole income bought paid enter railroad unable ticket account driven real recover mountain steamer speak past might begin contract deal almost brought less event off true took again inform both heart month children build understand follow charge says member case while also return those office great Miss who died change wire few please picture money ready omit anyway

lamb. You will never forget how to spell *separate* if you associate it with *parade*, which has the same Latin root. Then analyze the word: separate it into its parts; put together the meanings of these parts to see just what the word originally meant, or literally means; try to explain how the present or derived meaning comes from the original meaning. For example, take the word *conductor*. The dictionary shows us that it comes from the Latin *con* (with or together) + *ducere* (to lead) + *or* (one who). A conductor, then, is one who leads or directs other people. A knowledge of the derivation of a word frequently helps us to remember a peculiar spelling, as *Wednesday*, from *Woden*. Finally comes the meaning of the word. This includes definition and use, or uses. There should be practise in the use of words in sentences, in the various senses a given word may have. The word *stanch*, for example, is a transitive verb, an intransitive verb, a noun, and an adjective; and to know that word is to be able to use it in all four senses.

The best type of spelling book not only makes its selection of words by a comparative study of the lists and scales of the investigators, but it *organizes* these words according to scientific pedagogical principles. Derivative forms are grouped so that pupils come to see the system by which they are built up. Homophones are presented first in illustrative phrases or short sentences. Words phonetically similar are brought together, so as to make use of the principle of association. Interest is stimulated by the use of every proper device. By such means the number of separate facts that must be learned is reduced.

While it is true that only a few rules for spelling English words are really helpful, those few do help, particularly when the pupil arrives at them for himself *after* studying groups of illustrative words. The addition of the suffix *-ing* to *write*, *ache*, *guide*, *desire*, *bruise*, *increase*, *prepare*, etc., enables us to formulate the rule for dropping final silent *e* before suffixes beginning with a vowel.

By adding *-ed* or *-ing* to *compel*, *confer*, *refer*, *submit*, *acquit*, *control*, etc., we learn that monosyllables and words accented on the last syllable, ending in a single consonant preceded by a single vowel, double the final consonant before a suffix beginning with a vowel.

ABILITY IN SPELLING—THE AYRES SCALE

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
58	50	←THIRD GRADE										
79	73	66	58	50	←FOURTH GRADE							
88	84	79	73	66	58	50	←FIFTH GRADE					
94	92	88	84	79	73	66	58	50	←SIXTH GRADE			
98	96	94	92	88	84	79	73	66	58	50	←SEVENTH GRADE	EIGHTH GRADE ↓
100	99	98	96	94	92	88	84	79	73	66	58	50
except sent capture wrote else bridge offer suffer built center front rule carry chain death learn wonder tire pair check prove board inspect itself always something write expect need thus woman young fair dollar evening plan broke feel sure least sorry press God teacher November subject April history cause study himself matter use thought person nor January mean vote court copy act been yesterday among question doctor hear size December dozen there tax number October reason fifth	eight afraid uncle rather comfort elect aboard jail shed retire refuse district restrain royal objection pleasure navy fourth population proper judge weather worth contain figure sudden forty instead throw personal everything rate chief perfect second slide farther duty intend company quite none knew remain direct appear liberty enough fact board September station attend between public friend during through police until madam truly whole address request raise August Tuesday struck getting don't Thursday	spend enjoy awful usual complaint auto vacation beautiful flight travel rapid repair trouble entrance importance carried loss fortune empire mayor wait beg degree prison engine visit guest department obtain family favor Mrs. husband amount human view election clerk though o'clock support does regard escape since which length destroy newspaper daughter answer reply oblige sail cities known several desire nearly	sometimes declare engage final terrible surprise period addition employ property select connection firm region convict private command debate crowd factory publish represent term section relative progress entire president measure famous serve estate remember either effort important due include running allow position field lodge claim primary result Saturday appoint information whom arrest themselves special women present action justice gentleman enclose await suppose wonderful direction forward although prompt attempt whose statement perhaps their imprison written arrange	forenoon lose combination avenue neighbor weigh wear entertain salary visitor publication machine toward success drown adopt secure honor promise wreck prepare vessel busy prefer illustrate different object provision according already attention education director purpose common diamond together convention increase manner feature article service injure effect distribute general tomorrow consider against complete search treasure popular Christmas interest	often stopped motion theater improvement century total mention arrive supply assist difference examination particular affair course neither local marriage further serious doubt condition government opinion believe system possible piece certain witness investigate therefore too pleasant	guess circular argument volume organize summon official victim estimate accident invitation accept impossible concern associate automobile various decide entitle political national recent business refer minute ought absence conference Wednesday really celebration folks	meant earliest whether distinguish consideration colonies assure relief occupy probably foreign expense responsible beginning application difficulty scene finally develop circumstance issue material suggest mere senate receive respectfully agreement unfortunate majority elaborate citizen necessary divide	principal testimony discussion arrangement reference evidence experience session secretary association career height	organization emergency appreciate sincerely athletic extreme practical proceed cordially character separate February	immediate convenient receipt preliminary disappoint especially annual committee	decision principle	judgment recommend allege

This scale contains the 1,000 most commonly used words in the English language, arranged according to difficulty. The easiest words to spell are in Column A; Column B is just a shade harder; Column Z is the most difficult. Second-grade pupils, on the average, ought to make percentages ranging from 99 to 50 on Columns A to L. Third-graders should average 100 per cent on Column C, 99 per cent on Column D, and so on to 50 per cent on Column O. In a similar way you can read off in percentages the spelling ability expected of pupils of the higher grades. By means of these word groups a child's spelling ability may be located in terms of grades. Thus if a child were given a 20-word spelling test from the words of Column O and spelled 15 words, or 75 per cent of them, correctly, it would be proper to say that he showed fourth-grade spelling ability. This chart was prepared for the Russell Sage Foundation from spellings made by 70,000 children in 84 cities.

Such words as *deny, comply, query, verify, dusty, muddy, homely, pretty, jolly,* and others ending in *y* preceded by a consonant change *y* to *i* before *-ed, -er, -est, -able.* Thus: *denied, complied, dustier, muddiest, prettiest, verifiable.* But note the forms *denying, complying, studying.*

Final *e* is dropped before an ending beginning with a vowel (as *seize, seizure; conceive, conceivable*), but retained before an ending beginning with a consonant (as *achievement, encouragement*). Exceptions: *judgment, abridgment, argument, lodgment, acknowledgment.* The *e* is also retained when needed to keep the identity of a word (as *dyeing, shoeing, hoeing*), or to keep the soft pronunciation of a *g* or *c* (as *peaceable* and *changeable*). (*G* and *c* before *a, o,* and *u* are pronounced as in *gave* and *cat;* before *e, i,* and *y* they are pronounced as in *gentle* and *cent.*)

Most plurals are formed by adding *s* to the singular. But words ending in *s, x, z, ch, sh,* form the plural by adding *es.* Thus: *circuses, taxes, churches.* Singular forms ending in *y* preceded by a consonant form the plural by changing *y* to *i* and adding *es.* Thus: *salaries, factories, remedies, cherries, libraries.*

To avoid confusion between *ei* and *ie,* keep in mind the word *Alice,* in which you have *li* and *ce* to remind you that *i* follows *l,* and *e* follows *c.* This will help with words like *believe, relieve, receive, perceive,* etc.; but it applies only when the sound is long *e.* Otherwise *ei* is the more usual spelling, as in *deign, vein, rein, freight, height, sleight, foreign, counterfeit, heifer.* The old jingle is "Use *i* before *e* except after *c,* or when it's like *a* as in neighbor or weigh." But remember the exceptions: *financier, seize, weird, either, neither, leisure, inveigle.*

If you are confused about whether to end a word in *-able* or *-ible,* try to think whether there is a

noun related to it ending in *-ation*. If a word has a noun ending in *-ation*, the adjective generally also has *a* in its suffix, and ends in *-able*. Thus *accuse* has the noun *accusation*, and the adjective *accusable;* and we have *limitation, limitable; duration, durable; detestation, detestable*, etc. If there is no noun ending in *-ation*, the adjectives usually end in *-ible*, as *collectible, digestible, repressible*, etc.

There have been many attempts to introduce simplified spellings. The first was that of Noah Webster, who, in his 'American Dictionary' (1828) dropped the *u* from such words as *favour, honour, mould, colour*, and changed the French-derived *metre, centre, theatre*, etc., to *meter, center, theater*. These simpler spellings have largely taken the place of the others in America, but the English still cling to the old forms. Twelve spellings adopted by the National Education Association are recognized by the newer dictionaries and are in fairly general use; these are: *program, catalog, decalog, prolog, pedagog, tho, altho, thoro, thoroly, thorofare, thru*, and *thruout*.

SPHINX. Chiseled from solid rock nearly 3,000 years before the birth of Christ, the Great Sphinx of Egypt, like a gigantic sentinel, still guards the cemetery of Gizeh at the entrance of the Nile valley. It has the body and paws of a lion, but its head is a portrait statue of King Khafre, who built it and placed it before his pyramid tomb. "Wise as the sphinx" we sometimes say, and no wonder; for what secrets might not those lips of stone reveal could they but speak! For nearly 5,000 years it has crouched on the desert sands, gazing unmoved toward the east. Before its eyes generations, centuries, eras of history have unfolded; empires have grown up in splendid struggling power and have passed away in slow decay; the tide of civilization has swept forward, new religions have encircled the earth, new continents have been discovered, the world has been made over—yet the sphinx still stands patient and motionless in the tide of life.

Only one thing has changed the expression of that massive countenance. Grains of sand caught up by the hot swirling winds of the desert have kept up their tiny bombardment through the ages. Bit by bit they have scratched and chipped and rasped the solid rock until all the sharpness of angles and lines has melted away. The beard is gone; the nose is no more; the "graceful smile" described by visitors of old has vanished, leaving the strange inscrutable look which led the Arabs to call it the "Father of Terrors." Perhaps some desert vandals, some zealous Copts, enraged at the "pagan image," have helped to mar the surface of the figure, but the great mass of the body remains in crumbling outline defying time and man.

As we approach the sphinx where it looms between the river and the sands, we might mistake it for one of the many fantastic dull red and amber-colored rocks of the valley. At closer range this half-human,

THOSE PAWS WERE HIDDEN FOR 4,000 YEARS!

After being buried up to the neck in sand for centuries, the Sphinx was revealed in its entirety when an army of workmen cleared the sand away in 1926. Previously the neck had been repaired with concrete, where the sand had worn away great portions of the rock.

half-animal colossus becomes evident for what it is and we ponder on "the mighty Pharaohs, and Hebrew law-givers, and Persian princes, and Greek philosophers, and Antony with Cleopatra by his side, and Christian anchorites, and Arab warriors, and European men of science, all brought hither in succession by the unpausing ages to look into those eyes—so full of meaning though so fixed!"

The head of the sphinx measures 19 feet from top of forehead to bottom of chin and 91 feet in circumference at the broadest part, with the shoulders and the upper portion of the paws extending forward 56 feet. The mammoth body is 172 feet in length, while the height from the ground to the top of the head is 66 feet.

These dimensions were discovered in 1926 when the Egyptian government succeeded in digging away the surrounding sand, revealing the complete body of sculptured rock and the paws of built-up stone. Egypt has many smaller sphinxes, usually in pairs at the approach or entrance to a temple.

From the Egyptians the Greeks borrowed their idea of a sphinx, which they conceived as a monster with the head of a woman, the body and paws of a lion, and huge bird-like wings. According to the story, this monster put a riddle to all those who passed by, and devoured all who failed to guess it. After many had died in this way, the Theban hero Oedipus succeeded in solving the riddle and so caused the monster's death. (*See* Oedipus.)

The WORLD-WIDE *Search for* SPICES

How Pepper, Cloves, and Their Many Sharp-Flavored Cousins Have Made History, Inciting Discovery, Creating Commerce, Provoking Wars—The Precious Products of Tropical Climates and How They are Obtained

SPICES AND CONDIMENTS. If modern cold storage had been known in the days of Columbus, the New World might not have been discovered until centuries later. For without our modern means of keeping food palatable throughout the year, the Europe of the Middle Ages and later times found spices almost indispensable to flavor its poor and often half-spoiled food. In medieval England, for example, the usual winter diet consisted of meal and coarse salt meat, which became half-rotten by spring. So spices were in enormous demand to lend some savor to this monotonous and pleasureless fare. Cinnamon, cloves, and pepper were worth their weight in gold; and men risked their lives and fortunes in seeking new routes to the lands of spices—the East Indies and the neighboring parts of Asia.

For centuries these condiments, so common with us that we scarcely give them a thought, were among the most important articles of commerce. The spice trade was a leading factor in determining the rise and fall of states, in provoking wars, and in discovery and exploration. It was chiefly the desire to find new ways of access to this vastly profitable trade that led to the discovery of sea routes to the east and the discovery of America. Arabia was at first the great distributing center for spices, which were brought overland in great caravans. Venice rose to world power through her control of the Mediterranean trade in spices and other imports from the East. When Venice lost command of the trade through the discovery of new sea routes to the East, first Portugal, then Holland, rose to wealth and power largely through the spice monopoly.

In the days of Queen Elizabeth the Dutch went so far in their efforts to keep all the spice trade in their own hands that they cut down clove, cinnamon, and pepper trees in districts not directly under their control and inflicted the severest punishments on anyone who attempted to infringe on their monopoly. In Ceylon, the great cinnamon center, death was the penalty for the illegal sale of even a single stick of cinnamon; and this law remained in force until the English took the island in 1796. It was largely to break the grip of the Dutch on the profitable spice trade that the East India Company was formed in England, thus laying the foundations for British rule in India.

Most of our spices still come from the East Indies and the neighboring lands. Pepper, cardamom, and cinnamon are native to India and Ceylon; nutmeg and mace, cloves, clove-bark, turmeric, and ginger come from the Malay Archipelago; cassia bark from China. Africa gives us grains of paradise, the pungent seeds of a plant used largely in early days as a substitute for pepper, while the American tropics have supplied vanilla, red peppers, and the clove-like pimento or allspice. The colder climates of northern Europe and Asia have produced but few—coriander, cumin, caraway seed, parsley, mustard, and calamus root.

Many of these aromatic substances have other uses besides that of flavoring agents. Some are valuable in perfumery, confections, and scented soaps, as vanilla, cloves, and pepper, or in the manufacture of incense, as cinnamon. Many are utilized in medicine, as cardamom, ginger, nutmegs, oil of cloves, etc. Turmeric is used in dyeing, especially by the natives of India and China, and marjoram serves in dyeing wool. Other spices are used in various arts.

It is a remarkable fact that a large proportion of the spices are successfully grown only on islands, or near the sea. Nutmegs, cloves, vanilla, cinnamon, and cardamom may be termed island plants, and long before the "spice islands" are in sight, sailors know they are in the vicinity by the heavy fragrance borne to them by the land breeze.

The flavor of spices is due to the presence of aromatic oils secreted in the plant, but these oils are richest in different parts of the various plants. In cloves and capers, it is the flower buds which are particularly aromatic; in coriander, capsicums, and pepper, it is the fruit. The ginger, licorice, and turmeric of commerce are roots or underground stems, and cinnamon and cassia are the inner bark of a tree. In most of the savory herbs—sage, mint, thyme, marjoram, etc.—the leaves are richest in these essential oils, while nutmegs, caraway, and anise are seeds.

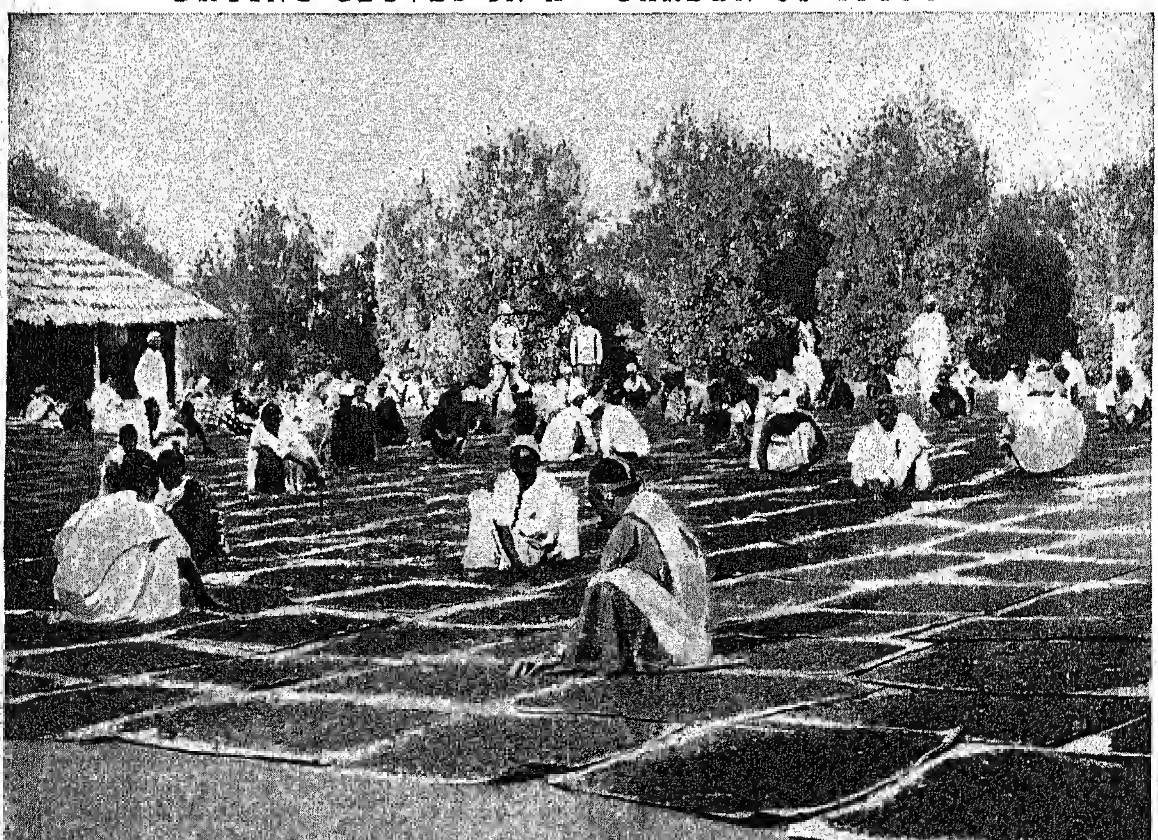
When the flower buds are utilized they are plucked just before they are ready to break into blossom. The whole clove, as we get it in the shops, is the dried flower bud of a small bushy tree. The four petals are closed into a tight ball, held by four fleshy sepals. One of the early uses of cloves is recorded in an ancient Chinese court order, wherein the officers of the court are required to hold cloves in their mouths while addressing the sovereign. Capers, which are used as a seasoning for sauces, etc., are the salted and pickled buds of a bushy plant which grows wild on the mountainous slopes bordering the Mediterranean Sea. The flower is "sensitive," opening when the sun strikes it, and closing again as the sun sets, so the flowers must be gathered very early in the morning, between daybreak and sunrise.

Cinnamon is the dried inner bark of several species of trees. This aromatic bark has long been popular, having been highly prized in biblical times. Resembling it in flavor is its close relative, cassia bark. Cassia buds, the dried unripe fruit of the cassia tree, are also used.

Pimento or allspice—not to be confused with the pimiento (*see* Pepper)—consists of the little unripe fruits of a tree which resembles the clove. The spice takes its popular name from its resemblance in perfume and taste to a mixture of cinnamon, cloves, and nutmeg, and with them forms the four spices to be found in every kitchen. The fruit is about the size of a black currant and resembles peppercorn. The word pimento is taken from the Spanish word *pimienta*, meaning "pepper."

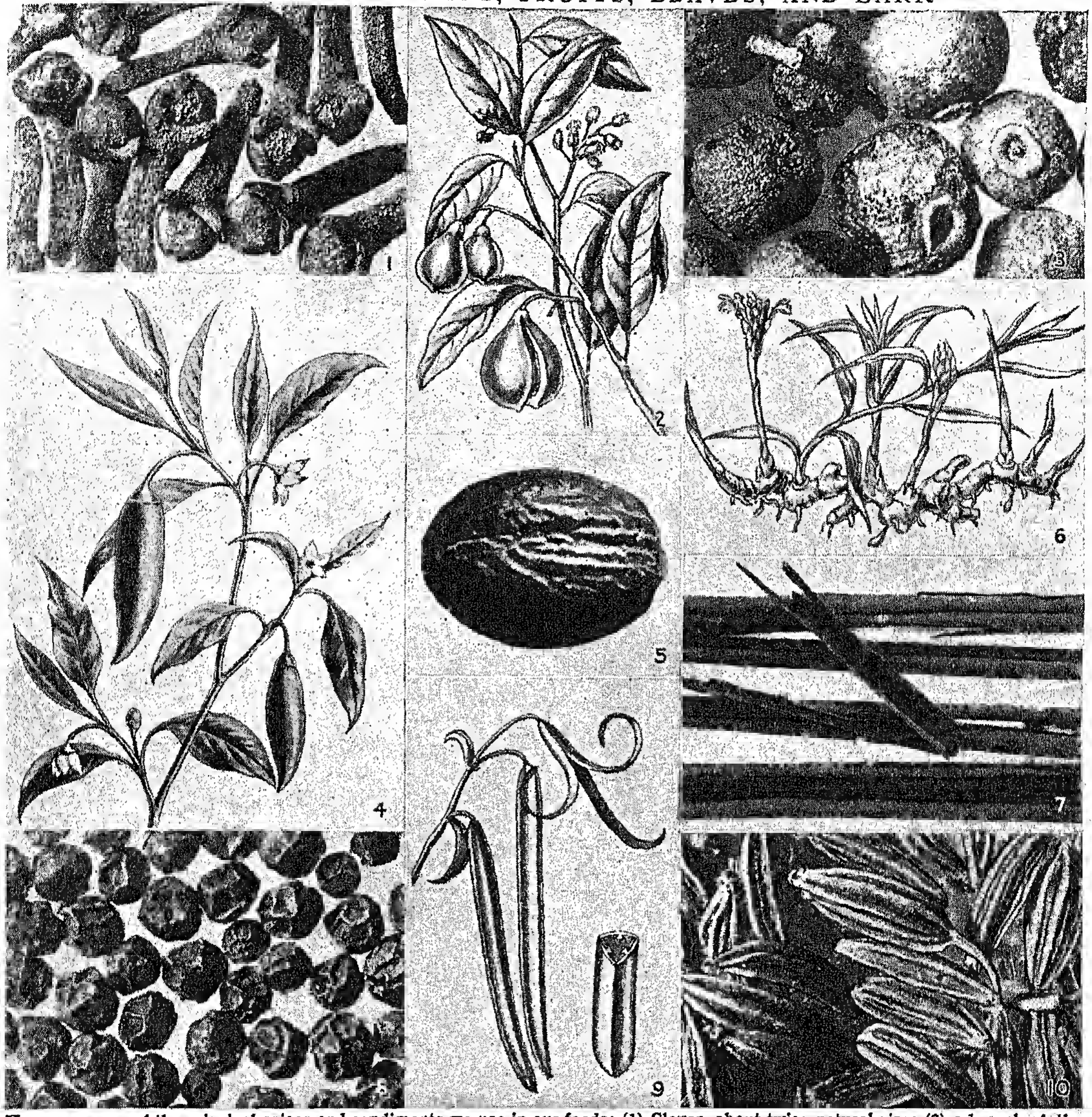
Coriander is one of the oldest spices, being mentioned in early Sanskrit and Egyptian writings. It is the fruit of a small herb growing on the shores of the Mediterranean, and is largely cultivated in India. It is valued as an ingredient in confectionery, to disguise unpleasant tastes in medicines, and as an ingre-

DRYING CLOVES IN A "GARDEN OF SPICES"



The flower buds of the clove tree, gathered by hand, are spread out on mats to dry in the sun, being sometimes previously dried by exposure to the smoke of wood fires. When first gathered they are reddish, but drying turns them a deep brown.

FLAVORS FROM SEEDS, FRUITS, LEAVES, AND BARK

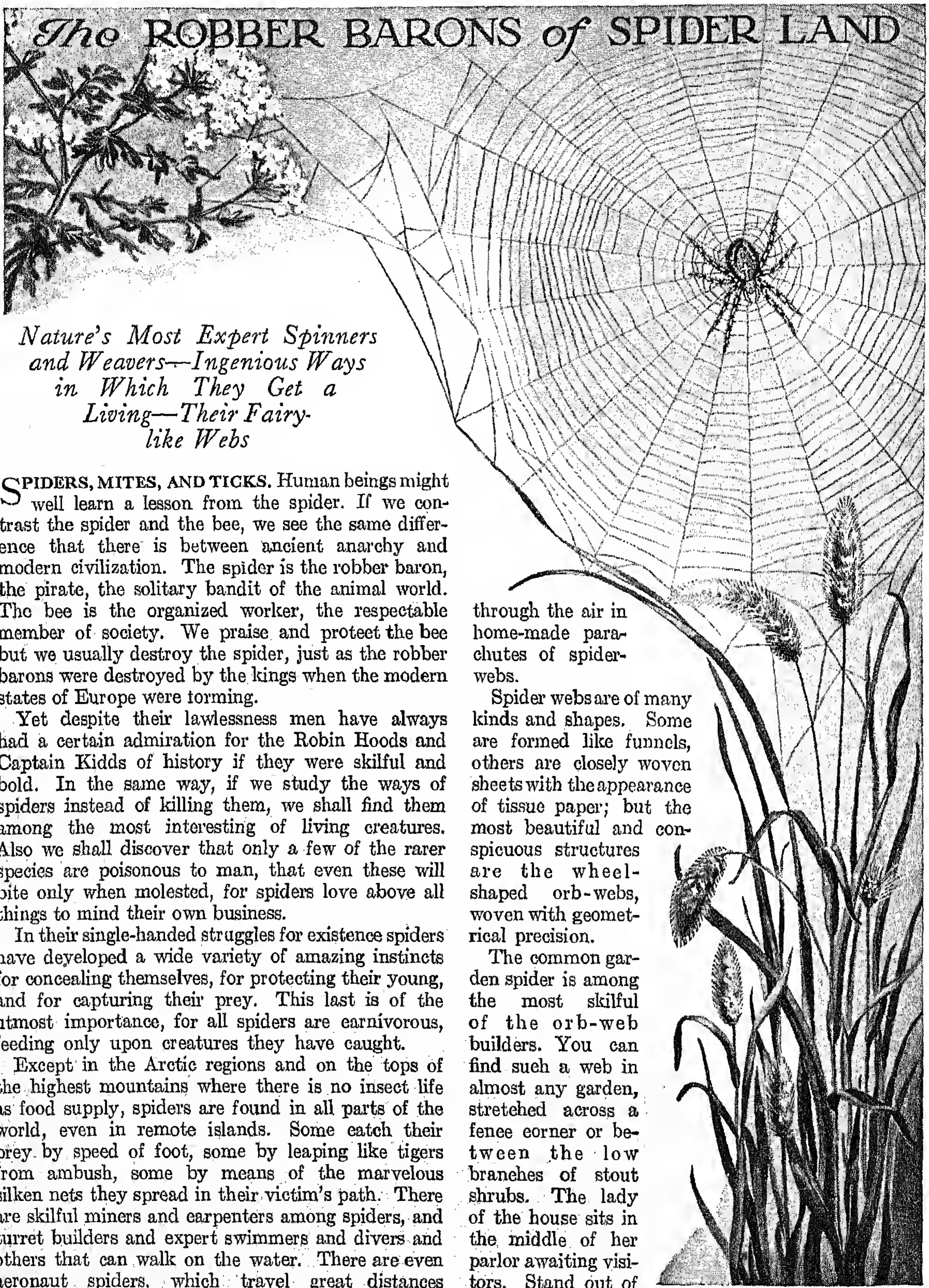


Here are some of the principal spices and condiments we use in our foods: (1) Cloves, about twice natural size; (2) a branch of the Nutmeg tree, much reduced, showing flowers, leaves and fruit; (3) Allspice berries, highly magnified; (4) a flowering and fruiting branch of Red Pepper; (5) a Nutmeg; (6) a growing root of Ginger; (7) a few strips of Cinnamon bark; (8) Black Pepper berries, somewhat magnified; (9) Vanilla beans — the pods are seven or eight inches long; (10) Caraway seeds, highly magnified.

dient in curry powder, "the salt of the Orient," which is a mixture of powdered sago with various spices. One of the spices often used in curry is the cumin, which is also used as a substitute for caraway seed in seed cakes. Dill, commonly known in the East Indies as cake seed, is the dried fruit of a plant which grows as a weed in southern Europe. It is used in pickling, the most familiar use being for "dill" cucumber pickles.

Another group of seasoning plants is cultivated in gardens as kitchen herbs, their aromatic flavor being especially valued in meat cookery. Among these are the sweet-smelling common marjoram, thyme, whose fragrant leaves and flower-tips are so well liked in seasonings and sauces, and tarragon, used fresh or dried for pickling and for spicing vinegar. Savory, whose fine peculiar flavor is used in pickling, sauces, etc.; sage, whose distinctive taste gives zest to the dressing with which the Thanksgiving turkey is stuffed; and parsley, cultivated for its finely cut aromatic leaves and used for flavoring soups and for garnishing, are all well known flavoring plants. Bay, the dried leaves of a large evergreen shrub of the laurel family, is used in many forms of cookery.

The ROBBER BARONS of SPIDER LAND



Nature's Most Expert Spinners and Weavers—Ingenious Ways in Which They Get a Living—Their Fairy-like Webs

SPIDERS, MITES, AND TICKS. Human beings might well learn a lesson from the spider. If we contrast the spider and the bee, we see the same difference that there is between ancient anarchy and modern civilization. The spider is the robber baron, the pirate, the solitary bandit of the animal world. The bee is the organized worker, the respectable member of society. We praise and protect the bee but we usually destroy the spider, just as the robber barons were destroyed by the kings when the modern states of Europe were forming.

Yet despite their lawlessness men have always had a certain admiration for the Robin Hoods and Captain Kidds of history if they were skilful and bold. In the same way, if we study the ways of spiders instead of killing them, we shall find them among the most interesting of living creatures. Also we shall discover that only a few of the rarer species are poisonous to man, that even these will bite only when molested, for spiders love above all things to mind their own business.

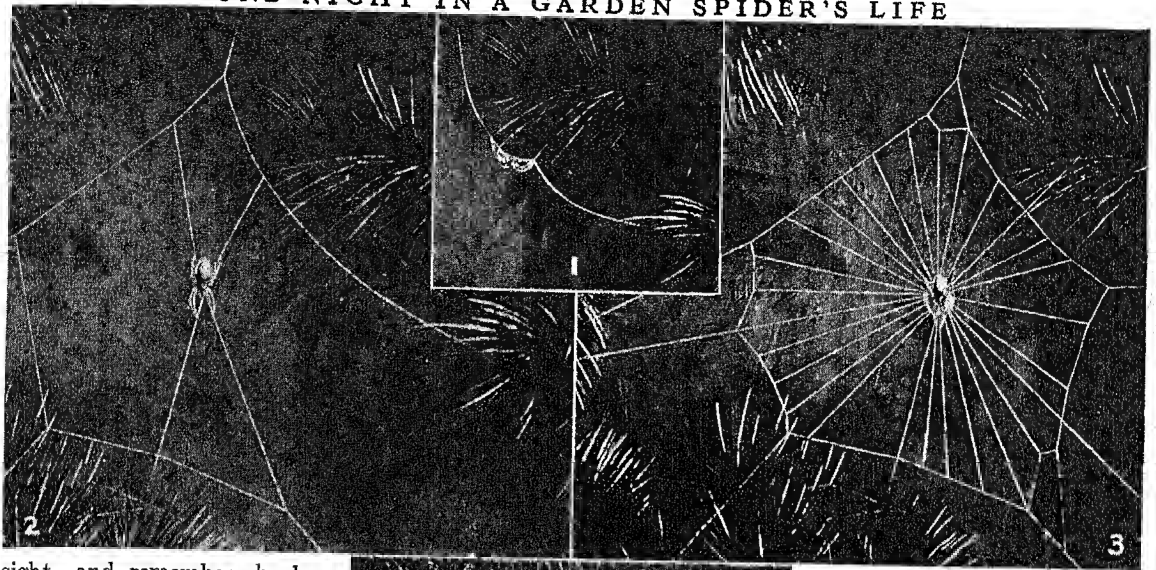
In their single-handed struggles for existence spiders have developed a wide variety of amazing instincts for concealing themselves, for protecting their young, and for capturing their prey. This last is of the utmost importance, for all spiders are carnivorous, feeding only upon creatures they have caught.

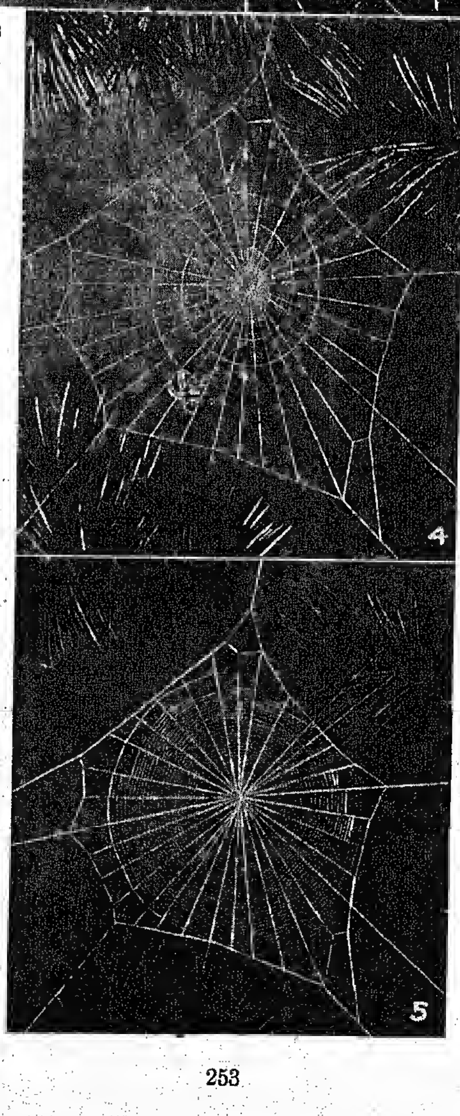
Except in the Arctic regions and on the tops of the highest mountains where there is no insect life as food supply, spiders are found in all parts of the world, even in remote islands. Some catch their prey by speed of foot, some by leaping like tigers from ambush, some by means of the marvelous silken nets they spread in their victim's path. There are skilful miners and carpenters among spiders, and turret builders and expert swimmers and divers and others that can walk on the water. There are even aeronaut spiders, which travel great distances through the air in home-made parachutes of spider-webs.

Spider webs are of many kinds and shapes. Some are formed like funnels, others are closely woven sheets with the appearance of tissue paper; but the most beautiful and conspicuous structures are the wheel-shaped orb-webs, woven with geometrical precision.

The common garden spider is among the most skilful of the orb-web builders. You can find such a web in almost any garden, stretched across a fence corner or between the low branches of stout shrubs. The lady of the house sits in the middle of her parlor awaiting visitors. Stand out of

ONE NIGHT IN A GARDEN SPIDER'S LIFE





These are actual flash-light photographs of a web under construction. Four and a half hours elapsed from the time the spider began until she finished, but she was temperamental and loafed three-fourths of the time. After hanging the first cable (1), she built a sort of frame (2), in which she fitted spokes, as in a wheel (3). To hold the spokes in position a spiral around the center was added (4), and finally the web was ready for its prey (5).

sight—and remember she has several eyes in her head and can see all around the compass—and fling a bit of dry leaf on the web. She darts out. She views that leaf with disgust, thinking the wind has played a trick on her. Very likely she will push it overboard, for she keeps her house clean and shining. But toss into the web a fly or other insect, and see the great difference in the behavior of the spider.

When a hard rain or wind comes along, the pretty house may be wrecked. Then you may watch the spider build it again. She has to do it before breakfast, too, or go hungry. She sits out on a leaf or twig or fence post, looking over the building site.

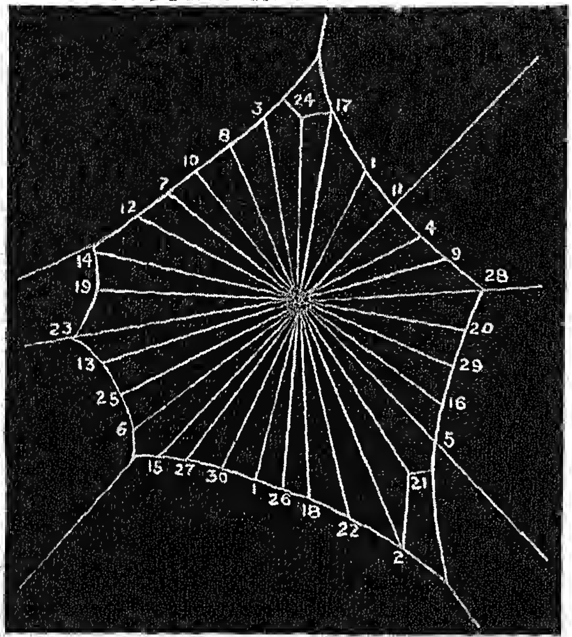
She drops, or jumps, from one support to another, paying out a tiny gray silk cable behind her, and fastening it wherever she can. Soon she has an irregular space inclosed. Do you know how fine those lines are? You would have to lay four or five thousand of them side by side, to make a ribbon an inch wide. You can see her run around those lines and pull them with her hind foot to test their strength. If one breaks she spins another.

Soon she has her space cut into four nearly equal parts like the quarters of a pie. Then she spins other spokes across the center or the wheel web. The many crossings make a stout hub. Starting at this hub, she weaves a spiral line, crossing the spokes and gluing the joints. The spiral is carried around four or five turns. This is the temporary scaffolding, made of tough dry threads like the spokes.

Now she starts near the outside edge of the wheel and circles around toward the center. This time she uses a much better silk. It is studded with little sticky beads. It is this thread that catches and holds the feet of unwary insects. As she travels back to the hub, the spider cuts the scaffolding away. When the new sticky spiral is complete, she spins new support lines from the outer rim of the web to the supporting branches and pulls them tight until the whole structure is as

taut as a drumhead. It hasn't taken more than an hour to make the web. If it is destroyed the spider seems to have plenty of material to build another.

PUTTING IN THE SPOKES



This diagram gives the order in which a Garden Spider actually put in the spokes in the web shown on the preceding page. You see that she did not go around the circle, but carefully added the spokes in such order that the strength of the net would be gradually increased without putting too great a strain on any part of it.

It is the female who does all this work. You will nearly always find her living alone. The male is very much smaller than she is, and he is not much of a worker. As the female bees do all the work, and drive the drones or males out of the hives, or even kill them, so the female spider barely tolerates her mate and even eats him if other food is scarce. She builds her own house, catches her own food, looks after her young, and lives most of the time in a busy solitude.

Myth and the Magic Web

A long time ago the work of this clever spinner and weaver was looked upon as pure magic. The Greeks made a wonder story about her. The spider was a maiden named Arachne. In a contest of spinning and weaving she proved herself better than the wise goddess Athena. To punish her for daring to be more clever than a goddess, Arachne was turned into a spider, and told to spend the rest of her days making her wonderful webs. It is because of this story that the scientific name *Arachnida* was given to the spider and its relatives, the scorpions, harvestmen (daddy-long-legs), mites, and ticks.

Sometimes you will find a spider's web bridging a small stream. How was the first thread carried across on which the web hangs? The spider simply waited until the wind was in the right direction, then mounted to a high branch and released a long free thread. It was carried over by the breeze and became tangled to the shrubs on the other side, then was drawn tight and fastened. Provided with this first cable path across the chasm, the spider found it easy to stretch the other foundation lines.

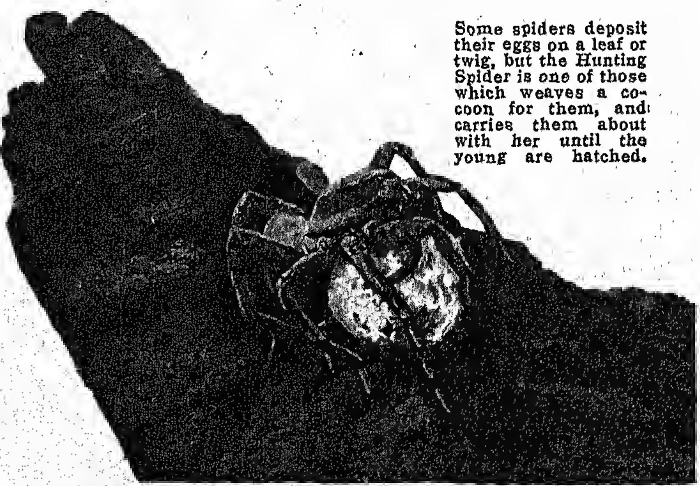
"Will You Walk Into My Parlor?"

Many spiders do not live on their webs, but hide in small woven nests near by. From the center of the web they stretch a tight trap-line to their den. This acts like a door-bell announcing visitors. A grasshopper, perhaps, jumps into the net. He sticks and struggles; the trap line jerks; out comes the spider like a flash across the web. Quickly she fastens a broad swathing band to the big floundering insect; then by a few dexterous kicks she rolls it over two or three times, and it is securely swathed in a tight shroud; a quick bite with her poison jaws completes the work. The grasshopper is then carefully carried to the hidden den and sucked dry.

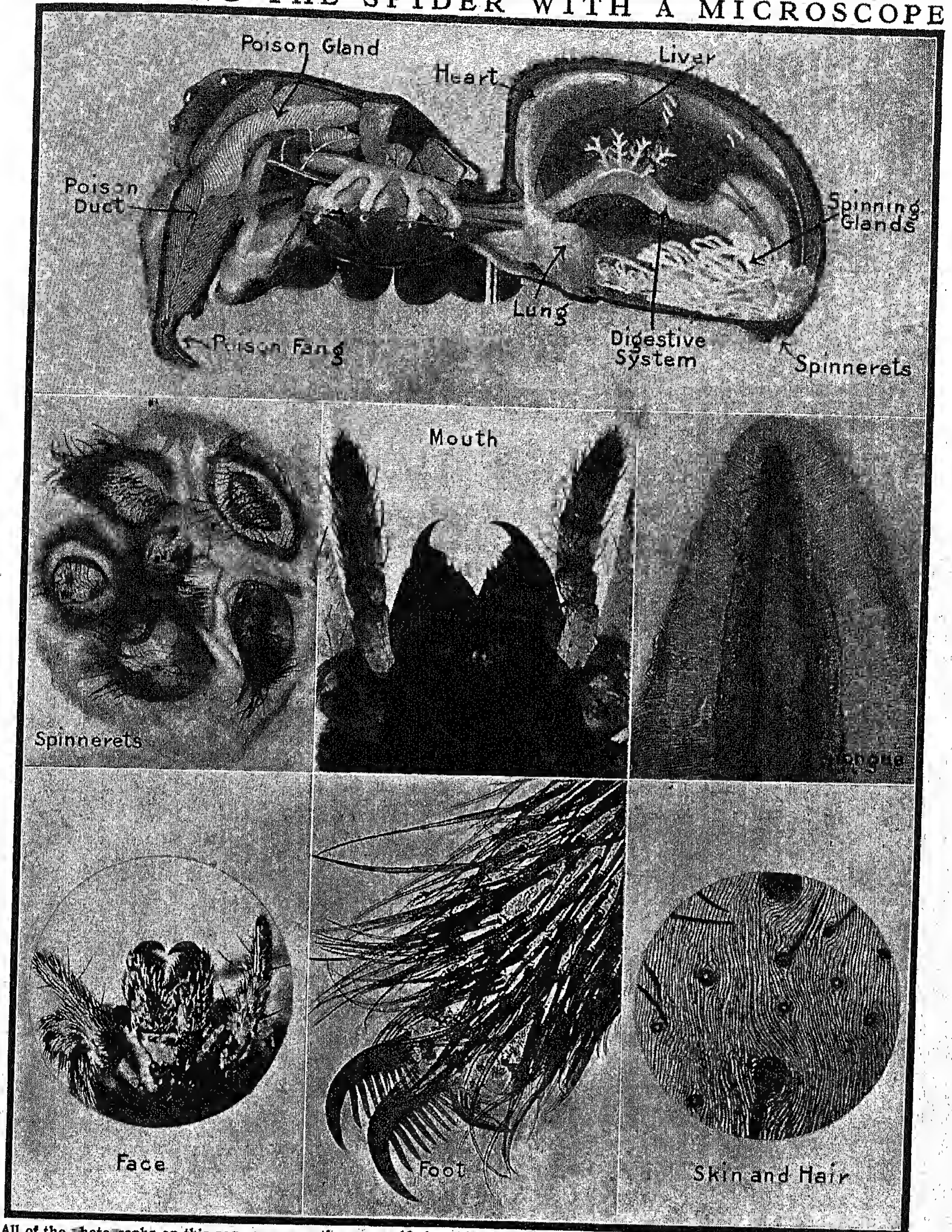
Spiders use their silken threads for many other purposes than spinning webs. Sacks are woven to carry eggs, and are either fastened to a leaf or twig or are carried about by the mother until the young hatch. Many species then transport the baby spiders on their backs until the youngsters are old enough to look out for themselves.

The interesting trap-door spiders, which dig holes in the ground and conceal the opening with hinged covers, line the inside of their tunnels first with a coating of saliva and earth and then with a layer of silk. The door may be a simple flap of silk and dirt, or it may be like a thick cord with edges accurately bevelled to fit the opening, so that when it is shut, one cannot distinguish it from the surrounding earth. On the inner surface of the door are tiny holes

CARRYING HER EGGS WITH HER



Some spiders deposit their eggs on a leaf or twig, but the Hunting Spider is one of those which weaves a cocoon for them, and carries them about with her until the young are hatched.

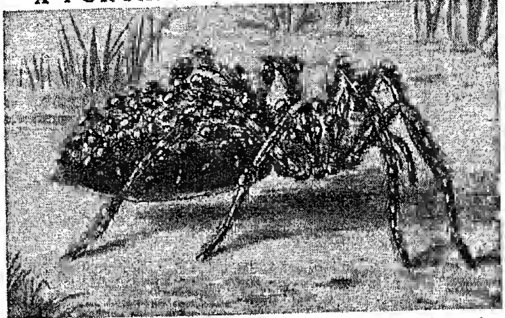


All of the photographs on this page are many times magnified, so that you may see exactly how a spider is built. The noteworthy features of the internal structure are the poison ducts, which end in the curved claw (*chelicerae*) in front of the mouth, and the spinning glands, which terminate in the spinnerets. All that part of the head which is visible when the spider is seen directly from the front is called the face. The spider can swallow only liquid foods. After it wounds its prey with its sharp claws and kills it by the poison flowing from the duct in the under side of the claw, the spider sucks the victim dry, and casts aside the hard parts.

and grooves which receive the claws and jaws of the spider when it is holding the door closed against its enemies. Some of the doors have elastic hinges and snap shut when the occupant goes out on a hunting expedition.

In Europe lives a species called the raft-spider, which builds tiny flat-boats of leaves and twigs lashed together with its silken cables. These are launched on the surface of some quiet pond when the spiders wish to make a raid upon water insects. The bold skipper often leaves the ship and runs out over the surface of the pool to catch hovering flies, or dives below to seize a toothsome water creature.

A PORTABLE SPIDER NURSERY

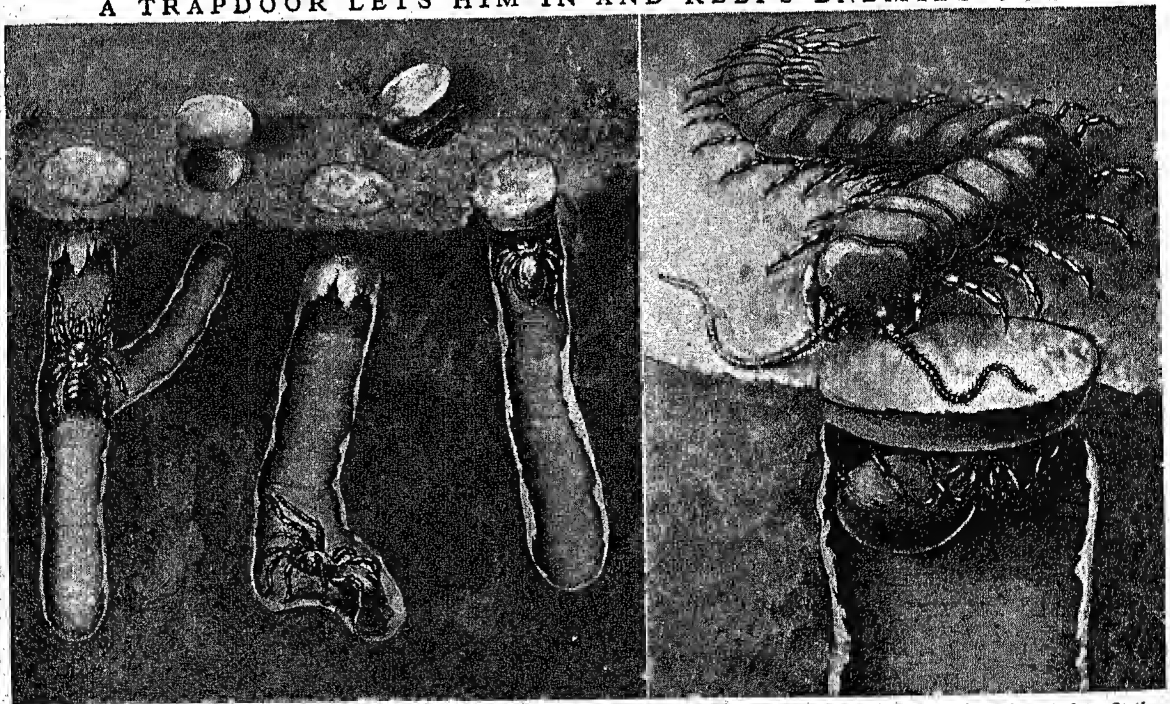


The Wolf Spider drags her egg-sac with her when she hunts prey. Then when her young are hatched, they crawl on her back, and are carried around, papoose-like, until they are strong enough to shift for themselves.

Even more ingenious is the true water spider which lives among the plants at the bottom of clear quiet ponds. There it builds a thimble-shaped dome of waterproof silk, fastened mouth downward to the stem of a plant or wedged in the crevice of a stone. Then it goes to the surface and catches air bubbles on the hairs of its stomach and between its legs and carries them down, brushing them off into its submerged cell until it is filled to the brim with air. To this home the water spider brings whatever prey it catches. Here too its eggs are laid and hatched, out of the way of all enemies.

But perhaps the most remarkable of all are the aeronautic spiders. Long before the invention of balloons or of airplanes, these spiders had solved the problem of aerial navigation. On a hot day the spider-balloonist climbs to the top of a bush or a fence post or merely to the summit of a clod of earth. There it lifts up its abdomen and spins out a thread which is carried upward by the air rising from the warm ground. Other threads are added to the first one, and perhaps spun together into a little fluffy cloud of gossamer. The breeze tugs at the airship, the spider lets go of the launching platform, hanging from its balloon by a slender thread, and away it sails, perhaps to travel for days before it comes to earth again. Ballooning spiders have been met by ships hundreds of miles from land. When they want to descend they spin out a drop-cord until it reaches the landing place. The spider, of course, is always at the lower end of the thread she spins.

A TRAPDOOR LETS HIM IN AND KEEPS ENEMIES OUT



At the left you can see Trapdoor Spiders in the security of their burrows. The doors, neatly hinged and carefully beveled to fit the openings, open at the slightest touch from below, and spring shut again when pressure is removed. At the right is a spider, safe in his hole, holding down the door, so that his arch-enemy and cousin, the centipede, cannot get in.

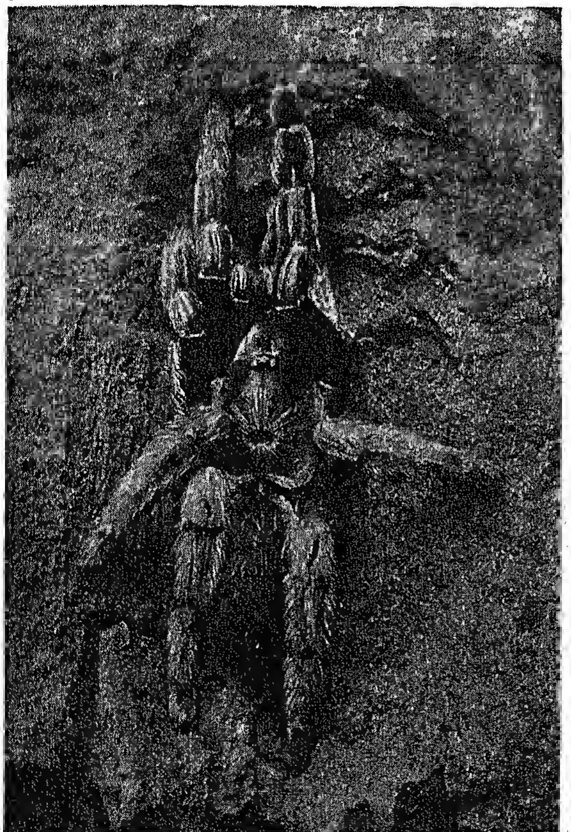
The safety devices and food-getting tricks of spiders are endless in number. Certain crab-spiders hide in flowers and seize insects that come for honey. The wandering wolf spider leaves his underground castle with the turret built about the entrance and runs down his prey in an open race. It is to this family that the famous tarantula of southern Europe belongs, the bite of which was supposed to cause the dancing madness called *tarantism* (*see* Tarantula).

The Dangerous Dance of Courtship

Whether or not spiders ever made any human being dance, it is certain that many of them are addicted to dancing themselves. Certain male jumping spiders, which are covered with hairs of brilliant colors, perform the most extraordinary antics before the females, leaping and swaying and displaying their beauty. Usually these dancers remain at a safe distance or approach with great caution, for if they fail to find favor they are likely to be pounced upon by the female and eaten. If a male escapes with only the loss of a leg, he need not worry, for spiders can grow new legs when needed.

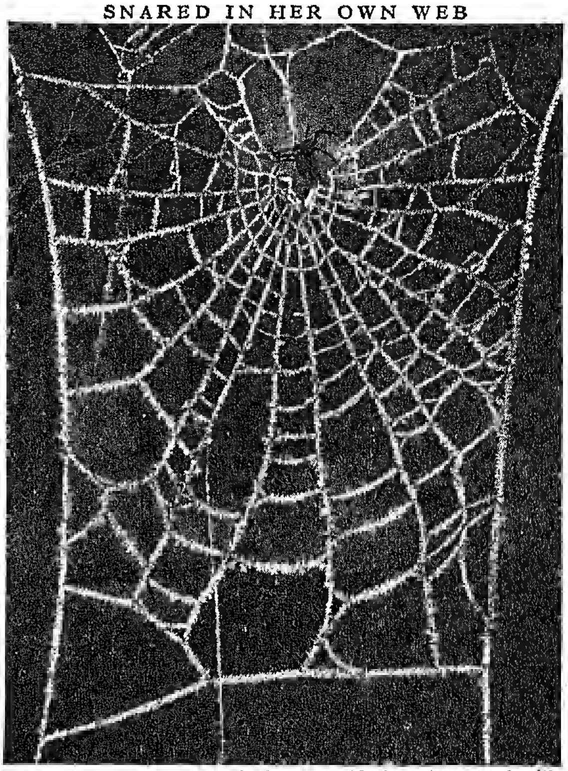
Spiders vary greatly in size. Some are no bigger than the head of a pin; others, like the giant bird-spider of South America, may have a leg span of more than seven inches. These monsters belong to the tarantula family. They have been known to catch and kill small birds, mice, snakes, and even fish.

A BIRD-CATCHER FROM SOUTH AMERICA



The Bird-Spider is the largest species known. Some have bodies three inches long, and their strong hairy legs have a spread of 7 or 8 inches. They feed on insects and small birds.

SNARED IN HER OWN WEB



This remarkable photograph shows a spider's web covered with hoar-frost, and the spider herself frozen at her post.

The poison of a spider is rarely, if ever, directly fatal to man. It destroys cells near the point of the bite and thus may bring about a fatal general infection or "blood poisoning." The "black widow," "hour-glass," or "shoe-button" spider, scientifically known as *Lactrodectus mactans*, has a bad reputation in the United States for causing deaths in this manner. The female is the dangerous one. She is about half an inch long, and coal black, marked with red or yellow or both. She usually has on the under side a patch of color shaped like an hour-glass, and red spots on the back. The male is half the size of the female and more conspicuously marked. These spiders are found under logs and stones and around outbuildings. They are most numerous in the southern states.

Spider thread is stronger than silk, but it can not be obtained in sufficient quantities for cloth making. It is used for the delicate cross hairs in telescopes and other optical instruments, where extra fine strands of great strength are needed.

Spiders belong to the order *Araneida* of the class *Arachnida*. This class includes also the scorpions, harvestmen or daddy-long-legs, mites, and other less familiar forms. The *Arachnida* are included with insects and crustaceans in the phylum of the *Arthropoda*, or creatures with jointed legs.

Although often called so, spiders are not insects. All insects have six legs, no more and no less, whereas spiders have eight legs. Unlike the insects, also, the head and thorax of spiders are consolidated in one segment, called the *cephalothorax*, which is connected with the abdomen by a slender stalk, the *pedicel*.

In the place of the antennae or feelers of insects, spiders have at the front of the head two clawlike appendages called *chelicerae* with which they seize their prey. Near the tip of each claw is the opening of the poison glands.

Spiders may have from two to eight eyes, depending on the species. Two types of eyes are distinguished: the "nocturnal" eyes, especially suited for seeing at night, when many spiders do most of their working and hunting, and the "diurnal" eyes, adapted to daylight vision. (For illustration, *see* article on Eye.)

Another set of organs fastened to the heads of spiders are the two *pedipalps*, which are sometimes mistaken for an extra set of legs. These are usually used for holding the spider's struggling prey.

The four pairs of legs of spiders are attached to the thorax. Each leg consists of seven segments and ends in two or three sharp claws.

The spinning organs are situated near the rear of the saclike abdomen on the under side. They consist usually of three pairs of "spinnerets" to which is added in certain spiders another organ, the *cribellum*. Small spinning tubes, sometimes a hundred or more in number, are distributed over each spinneret, and through them the silk is expelled from the body. The cribellum when present is used to spin broad bands of silk composed of many slender threads.

Those Tiny Pests, Mites and Ticks

Mites and ticks (order *Acarina*) are distinguished from spiders in having the abdomen fused with the cephalothorax. This gives them a more or less saclike appearance. As a rule they have four pairs of legs, although the newly hatched young have only three pairs. Most mites are extremely small, the largest being only half an inch in length.

Birds and mammals are often infested with mites. The poultry-mite sucks the blood of chickens. Others merely eat shreds of skin and the feathers of birds. Itch-mites produce the disease of domestic animals called scabies or mange.

Of the species that attack plants, the little scarlet mite called "red spider" is the best known. It is a common pest in greenhouses. The four-legged gall-mites produce swellings or galls on the buds and leaves of plants. Some mites injure food products, as cheese, sugar, flour, and dried meats.

The water-mites have legs fitted with long hairs for swimming. Some are free-living, some cling to aquatic insects, and others live in the gills of mollusks. Many mites are harmless, since they feed on decaying matter. A few are beneficial, destroying the eggs of grasshoppers and feeding on plant pests.

The largest mites, those belonging to the family *Ixodidae*, are commonly called ticks. They suck the blood of mammals, birds, and even reptiles. The southern cattle-tick transmits tick fever, or Texas fever, from one animal to another.

Some That Prey on Man

Man is annoyed by several species of mites and ticks. One minute parasite, a wormlike mite, lives in the hair-sheaths of the human skin. The "red-bugs" of the Southern states burrow under the skin and cause serious irritation. They are the young of harvest-mites (commonly known as "jiggers"). The disease known as Rocky Mountain spotted fever is also transmitted by a tick.

The life story of the wood-tick is typical of the parasitic kinds. The adult deposits numerous eggs on the ground. About a month later they hatch into small six-legged creatures called seed-ticks. These crawl up vegetation and await the coming of a suitable host, such as a bird or mammal. If the ticks succeed in attaching themselves, they insert their beaks, fill with blood in four or five days, then drop off, molt their skins, and gain an extra pair of legs. The nymph, as it is now called, has habits similar to those of the seed-tick, attaching itself, feeding, and again dropping off and shedding the skin, thus attaining the adult stage. The change from one stage to another can take place only after a full meal of blood, and the female, too, has to gorge on blood before laying eggs.

SPINNING AND WEAVING. Among the wonders of modern industry the great textile mills, turning out miles and miles of beautiful fabrics a day, have a high place; and the marvelous machines which they employ are among the triumphs of the inventor's skill. But fundamentally cloth making involves only two processes—spinning and weaving—both of which man had discovered long before he had learned to write.

Spinning consists in drawing out and twisting the prepared fibers of flax, cotton, wool, or other materials, so as to form thread or yarn suitable for weaving. Weaving, in turn, is the art of interlacing lengthwise yarns ("warp") with crosswise yarns ("weft" or "woof") so as to produce cloth.

For thousands of years the only means of spinning were the spindle and distaff, such as are pictured on the monuments of ancient Egypt, and such as may still be seen in the hands of peasant women in many backward parts of the world today. The prepared fibers were loosely bound to the end of the "distaff" (a short stick) which was held in the left hand or stuck in the spinner's belt. The notched end of the "spindle" was then caught in some of the fibers on the distaff; these were drawn out by the spinner's hands, and twisted into yarn by setting the dangling spindle to rotating, a "whorl" of stone or clay being attached to its opposite end to assist this operation. When a yard or so of yarn was thus spun, it was wound about the shaft of the spindle and fastened and the operation was repeated. Threads of wonderful fineness have been fashioned in this primitive way. The cobweb-like muslins of India were woven

on a bamboo spindle lightly weighted with clay. The thread was so fine that 253 miles of it were spun from a single pound of cotton.

The date of the invention of the spinning wheel is not known. Although it is known to have existed earlier, it did not come into general use in Europe until the end of the 15th or the beginning of the 16th century. The principle of spinning with the spinning wheel was the same as with the hand spindle, but the spindle was mounted and turned by the wheel. More uniform yarn could be spun, and spinning was faster.

In weaving, no notable improvement over the primitive hand loom was made until the invention of Kay's "flying shuttle" in 1733. Before this time two operators had been needed to weave a wide cloth, or "broad cloth," one to slide the shuttle across the bed between the threads of the warp and another to send it back. But with Kay's device only one person was needed to keep the shuttle flying back and forth continuously.

With the flying shuttle the output of a loom was doubled. Weaving went so fast that more yarn was needed than the spinning wheel could produce. As the demand for yarn increased and prices rose, many set to work to find a speedier method of spinning. Among them were James Hargreaves, who invented the spinning jenny; Richard Arkwright, who developed a roller frame run by water power; and Samuel Crompton, who combined these two machines into an invention called a "mule." (*See* Industrial Revolution; Arkwright; Crompton; Hargreaves.)

It is the mule, with minor improvements, that is used for spinning today. (*See* Wool.)

These new developments necessitated further improvements in weaving. In 1785 Edmund Cartwright patented his power loom (*see* Cartwright). Modern automatic looms were developed from this. Even before the power loom, inventions were made which led to the "Jacquard loom" (named for the Frenchman who perfected it in 1804) for weaving figured fabrics. (*See* Lace; Silk.) It was controlled by perforated cards. These let needles through to raise the warp threads in combinations that produced the desired pattern. A new card, with its own special set of perforations, was used for each lifting of the warp threads. The principles of this machine are used in the specialized power looms of today. (*See also* Cotton; Textiles and Embroideries.)

THE BRIDAL WREATH

The dainty white sprays of the bridal wreath make this a favorite variety of spirea. It gets its name from the fact that in temperate climates it comes into full bloom in June, "the bride's month."

SPIREA (*spī-rē′ȧ*). In meadows and gardens throughout the temperate parts of the Northern Hemisphere we find the flowering shrub called spirea. All the species—about 70—bear graceful clusters of tiny white or pink flowers. The plumy bridal wreath, the woolly-leaved hardhack, or steeplebush, and the Vanhouttei are among the best known. Common varieties are used for hedges.

The spirea's five-petaled flowers grow in clusters. In the center of each flower are a number of little stamens which give the clusters a dainty, lacy appearance. Spirea is a large genus of the rose family. Scientific name of bridal wreath, *Spiraea prunifolia;* of hardhack, *Spiraea tomentosa;* of Vanhouttei, *Spiraea vanhouttei*.

SPIRITUALISM. Can the spirits of the dead communicate with the living? The belief that they can and do has been widely held at all times and among all peoples. In modern times this belief has crystallized into an organized doctrine called spiritualism.

The modern spiritualistic movement began in 1848 when Kate and Margaret Fox reported that they heard mysterious knocks in their house at Hydesville, N. Y. They interpreted these "messages from the spirit world" and became the first spiritualistic "mediums." Soon the movement became world-wide.

At spiritualistic "séances," or sittings, many strange occurrences take place. While the medium is in the trance state, raps and other sounds are heard, lights appear, and heavy objects move. By such manifestations, and by using the voice of the unconscious medium, departed spirits are supposed to convey messages to the living.

By 1880 the movement had grown so large that it attracted the attention of scientists. In 1882 the Society for Psychical Research was organized in England to study "supernormal" phenomena. Although many mediums were found to use trickery, there remains a considerable amount of apparently genuine phenomena which have not yet been satisfactorily explained.

SPOKANE (*spō-kăn′*), **WASH.** Limitless electrical energy for turning factory wheels, operating mines, grinding wheat, and running trains, and a network of railway lines radiating in all directions have made Spokane the second city of the state and the financial and distributing center of the "Inland Empire." This great region extends from the Cascades into the Rockies of western Montana, and from British Columbia to Oregon. It has billions of feet of standing timber and rich mineral deposits to the north and east of Spokane, the fertile wheat fields of the Palouse and the Big Bend country to the south and west, and the grazing lands and orchards of the Yakima Valley beyond the Big Bend. White pine, lead, silver, wheat, apples, potatoes, sheep, hogs—a wealth of products comes from this empire to Spokane for shipping to all parts of the country. Much of this area is already irrigated, and the Columbia Basin Irrigation Project will make agriculture possible on an additional 1,200,000 acres.

Spokane is in eastern Washington less than 20 miles from the Idaho border. Its situation on the plateau between the Cascades and the Rockies, at an elevation

of 1,891 feet, gives it an invigorating though equable climate. The Spokane River cataracts over Spokane Falls in the center of the business district. Here and at another falls within the city are two of the many power plants which supply electricity throughout the region. Spokane's chief industries are meat packing, flour milling, fruit and vegetable canning, and the manufacture of lumber and lumber products, railroad cars, and locomotives. The water supply is pumped from a subterranean river below the Spokane. On the rimrock above the river are many fine parkways. Some of the city's most beautiful homes are perched on the slopes of the valley and along these drives. Near the north end of Downriver Parkway is the mile-long Deep Creek Canyon. Its walls tell stories of lava floods and scouring glaciers. Among the thousands of acres of parks are Cliff Park, which affords a good view of the valley, and Manito Park, famous for its sunken gardens.

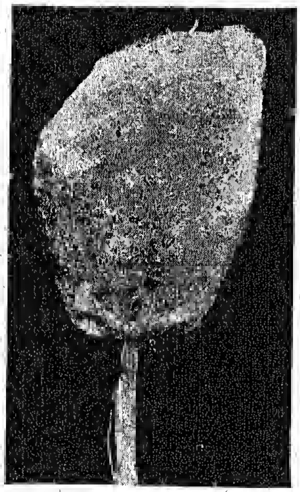
The eastern division of the Washington State Museum has a fine collection of Indian arts and handicrafts. Spokane's educational institutions include Gonzaga University, a Roman Catholic school for men; Whitworth College, a Presbyterian school; and Spokane Junior College.

Fort George Wright, with Geiger Field, west of the city, is the Army Air Forces headquarters for the Northwest. Felts Field, the municipal airport, is also used by the Army Air Forces. It is the divisional headquarters of the Northwest Airlines. Near the city are an army maintenance and supply depot and a naval supply depot.

The first permanent settlers on the site of Spokane were J. J. Downing and S. R. Scranton, who built a sawmill near the falls in 1871. James N. Glover, who bought out these men two years later, started a store and laid out the little town of Spokane Falls. This was incorporated as a city in 1881. The arrival of the Northern Pacific in the same year marks the beginning of the city's rapid growth. It is now served by five transcontinental railroads. The first public school was built in 1878 and the first newspaper was started in 1879. The commission form of government was adopted in 1910. Spokane is an Indian word meaning "children of the sun." Population (1940 census), 122,001.

From the OCEAN FLOOR *to Your* BATH TUB

The Strange Life of the Water Animals Whose Skeletons Help Us Keep Clean



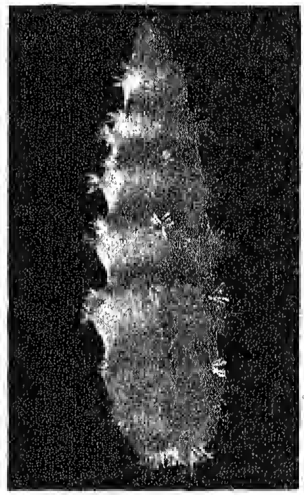
This is the Glass-Rope Sponge, remarkable for the strand or rope, composed of long twisted spicules which look like glass threads, by which the sponge anchors itself in the mud.

SPONGES. Sponges have been known for thousands of years, and are spoken of in Homer's 'Iliad'. Yet it was not until the 19th century that their right to be placed in the animal kingdom was universally admitted. Like plants they are always fixed and never move about and they have not eyes nor other sense organs, nor legs, nor any of the internal organs that we usually think of as belonging to animals. Yet they have the mode of feeding, and type of egg cells and their development, that belong to animals. And in other obscure ways they resemble animals and not plants.

Of course this means *living* sponges. Perhaps you are thinking of what we usually call "sponges," which are only the dry skeletons of sponges. In life these were all filled in and covered over with the soft jelly-like flesh of living cells.

Sponges of all kinds always live in water. Most of them are sea forms, but one family is common in fresh water in most parts of the world. The marine forms live mostly in shallow water, down to a few hundred feet deep; but some live in the deepest seas.

Sponges are of many sizes and forms and colors. One is very simple, an inch or less in length, and branching like a delicate bit of sea-weed. Another is like a small vase a half-inch long. Others still are in the form of big vases a foot or more in diameter. "Finger-sponges" often grow on oyster beds and look somewhat like a many-fingered hand. The wonderful "Venus's flower-basket" is about the size and shape of a banana. Ordinary bath sponges when living have much the size and shape that we know from their skeletons, with the firmer smooth end attached, and the softer rough end free.

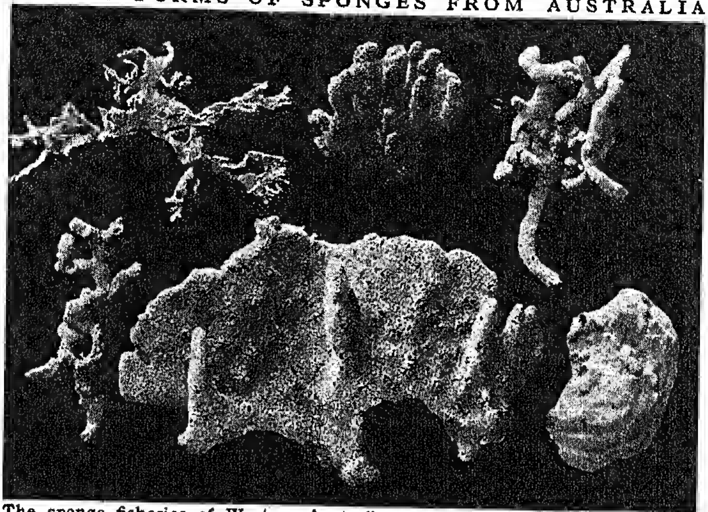


The sharp spicules of this sponge are tiny lustrous white fibers. This is one of the Glass Sponges, so named because their skeletons are made of silica, one of the constituents of glass.

Some sponges live only attached to other animals like crabs; and some branching tubelike forms burrow into oyster shells for their homes. Fresh-water sponges live mostly on the under side of stones and floating objects, in ponds and slowly flowing streams. They are spreading squashy objects, yellow or green in color, and it is hard to think of them as animals. But this is just another case where we have to change our ideas of things!

Even aside from their useful purposes, the skeletons of sponges are among their most interesting and important parts. In the ordinary bath sponges, the skeleton is of hornlike material and forms an intricate complete meshwork of varying degrees of fineness. In others, the skeleton consists of needle-like rods and fibers of limy material, interlocked in intricate ways. In others still, the fibers and rods are of flinty material. The wonderfully beautiful skeleton of the "Venus's flower-basket" is made of flinty fibers intertwined and interwoven in ways so delicate and intricate that one wonders that such a simple and lowly creature as a sponge could have formed it and had it for its skeleton. Of course, when we speak of skeleton, we don't mean that it is at all to be compared with our own—only that it serves to give support and protection to the sponge.

VARIED FORMS OF SPONGES FROM AUSTRALIA



The sponge fisheries of Western Australia are not yet of great commercial importance, but they supply all varieties from the smaller ones which look like seaweed or like a cluster of worms to the larger complex "glass" sponges.

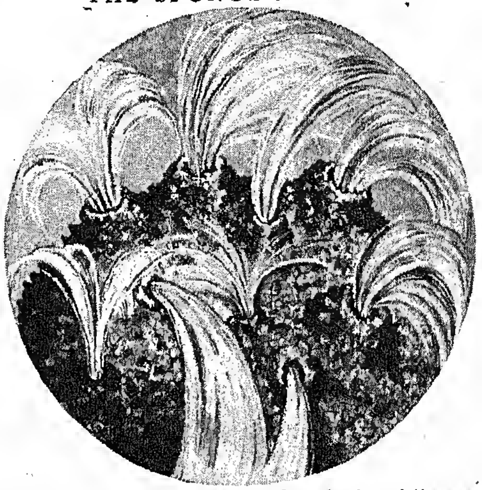
Although sponges are in most ways very simple animals, they are rather difficult to understand, for they are so different from the animals with which we are familiar. One very simple type is just a small narrow tube a half-inch long, attached at one end, with the outer or free end open. A thousand invisible pores admit water to the chamber within. This chamber is lined with very peculiar small cells, each one provided with a lash which keeps the water moving in through the small pores, and out through the large one. This water contains oxygen for breathing,

GIANT SPONGES FROM THE WEST COAST OF FLORIDA

These would make very rough bath sponges, but they are fine for washing windows, cleaning machinery, and other heavy work. They were only a small part of one day's "catch" delivered at Tarpon Springs, Fla., which is the greatest shipping point for sponges in the world. The Florida sponges are usually coarser and not so durable as those from the Mediterranean, but the Florida sponge fisheries are commercially much more important because their yield is much greater.

and very minute particles of food which are swirled into the cells to be digested. In large sponges millions of pores admit the water to intricate systems of branched canals on the inside, which have tiny chambers lined with the feeding cells. The canals lead like flues to the larger chimney-like openings and so to the outside. It is these large holes that we see in ordinary sponges.

THE SPONGE AT WORK



The only work the sponge does is to feed, and the sea really does this for him, because he gets all his food out of the currents of water which enter his body through pores opening into internal chambers or tubes. The used water, containing waste products, pours out through large openings as shown above.

Sponges as we usually know them are not single animals, but "colonies" of many individuals. The original very small single sponge forms buds, much like the budding of twigs on plants. Each bud is a new sponge, but soon all are so closely knit together that it is hard to distinguish the separate animals in the common mass. Small sponges, three or four inches in diameter, may consist of a dozen or more individuals.

Sponges also hatch as larvae from egg cells only a thousandth of an inch in diameter. The larva swims away from the parent, anchors itself, and begins to grow. In 25 years it may be a 2½-foot sponge. Possibly because of its peculiar odor, a sponge is hardly ever eaten by other animals, and many crabs, mollusks, and worms live safely inside its openings. Many sponges, however, die of a fungus disease.

Where and How Sponges are Caught

The world's chief sponge fisheries are the Gulf of Mexico off the west coast of Florida, the Caribbean Sea around Cuba and the Bahamas, and the coastal waters of the central and eastern Mediterranean.

To obtain the chief American sponge, the soft yet durable *sheep's-wool*, crews may sail 50 to 80 miles out from shore and send deep-sea divers down 60 to 120 feet or more. Encased in a suit and helmet, the diver carries a knife to fight off the barracudas and sharks, and a hook to tear the big sponges from their beds. For 20 minutes to 2 hours, until another diver relieves him, he collects sponges and puts them into net baskets lowered by rope from the boat.

The crew members kill the collected sponges on deck by walking barefoot upon them. The sponges are then hung over the side of the boat to dry. Next, they are scraped and clubbed to rid them of the dead tissue. Finally, they are washed in tubs of sea water and strung up, ready for the auction market when the boat reaches port.

In the Mediterranean, sponges are often obtained by naked divers who can go straight down 100 feet or more by holding heavy stones in their hands. Clasping his sponges, the diver is pulled up by a rope attached to his wrist. In some places, sponges are "hooked" with long-handled forks manipulated by men in small boats. The men locate the sponges by looking through a "sponge glass," which is a wooden bucket with a glass bottom. To restock depleted beds, sponges are propagated artificially. Small pieces of live sponge are attached to sticks or tiles and planted in the sea bed. They grow fast and can be harvested in two or three years.

In some years there has been a shortage of animal sponges, and this has encouraged the use of substitutes. One of these is the *loofa* or *luffa sponge*, a mass of fiber from the inside of the loofa gourd, which grows in Japan, China, India, Central America, and the West Indies. It is used especially to filter the water in the cooling systems of marine engines. *Rubber sponges* also have come into wide use (*see* Rubber). *Viscose sponges*, very similar to animal sponges in physical properties, are made by fluffing up viscose rayon while it is still in the liquid state and then hardening it (*see* Rayon).

Sponges belong to the phylum *Porifera*. Scientific name of common bath sponge, *Euspongia officinalis;* of sheep's-wool sponge, *Hippospongia gossypina;* of glass-rope sponge, *Hyalonema mirabilis;* of Venus's-flower-basket, *Euplectella aspergillum;* of common fresh-water sponge, *Spongilla lacustris.*

SPRAYING AND FUMIGATING. Among the best weapons against insects, molds, and bacteria that destroy crops or plague households are poisonous sprays, powders, or gases. The sprays and powders may be spread upon the threatened crops or upon the pests themselves. When these weapons are used against insects, they are called *insecticides*. Preparations that destroy fungus growths are called *fungicides;* and those that kill bacteria are *bactericides*.

If the insects belong to the group which chews or bites off portions of the plant, as do the worms and beetles, they may be destroyed by poisoning the surface of the plant with solutions such as Paris green, white hellebore, and London purple. If they suck the sap or plant juices, as do the plant lice, scale insects, plant bugs, thrips, and leaf hoppers, they are destroyed by caustic solutions, such as the kerosene emulsions, soap washes, lime and sulphur, and tobacco sprays that burn the bodies of the insects and suffocate them by closing their breathing tubes or spiracles. Poisons may be applied as powders dusted over the leaves by use of a bellows, but more often they are mixed with water and applied in liquid form. The solution may be sprinkled on with a whisk broom or by syringes; but power spraying machines are

now used in large orchards and vineyards, and hand sprayers in gardens and small orchards. It is important that the material be applied evenly to prevent injury to the leaves of the plant, and over as much surface as possible to do the most harm to insects.

The fungicides also may be either dusted or sprayed upon the infected plants. The one most generally used is called "Bordeaux mixture," so named from the accidental discovery of its usefulness in Bordeaux, France, in 1882. The fungicides destroy the delicate tissues of the fungus growth without injury to the "host," as the plant upon which the pests feed is technically called.

Extensive crops and orchards are sometimes dusted by low-flying airplanes that scatter the poisonous powders with the air currents from their propellers. When only a few trees are infected, the spread of disease is often checked by covering them with tents or bags which are then filled with hydrocyanic acid vapors. This does no harm to the tree or its fruit.

Killing the Insects That Plague Man

For killing the flies and mosquitoes that get into houses, special sprays have been developed from kerosene, containing chemicals such as methyl salicylate. These chemicals attack the *chitin*, which forms the skin or shell of all insects (*see* Insects).

To get rid of insects that hide in cracks and walls—cockroaches, clothes moths, bedbugs, and the like—it may be necessary to fumigate the premises. This is accomplished with various deadly gases, including hydrocyanic acid, gas mixtures containing carbon tetrachloride, and a few others. People and pets must leave the premises during the fumigation, and because of the danger involved these operations should be undertaken only by professionals. Cities usually require that a permit for fumigation be issued and that signs be posted warning people against entering the premises until they are thoroughly aired out. (*See also* Antiseptics.)

Ammunition for a Ceaseless War

Millions of dollars are spent on sprays and spraying outfits every year. Men working through the Department of Agriculture and agricultural experiment stations and colleges devote their lives to discovering new preparations and methods for combating insects and fungus growths. The following are some of the most important insecticides and fungicides:

Paris green (6 ounces in 50 gallons of water)—used in destroying the potato beetle; may be used alone or in compounds with arsenate of lead.

Arsenate of lead (2 pounds of paste in 50 gallons of water)—can be applied in stronger mixture than Paris green or other arsenical poisons without injury to foliage.

Kerosene emulsion (2 gallons of kerosene and 1 gallon of hot water in which a pound of soap has been dissolved)—an inexpensive caustic solution, which is diluted for use with from 9 to 12 parts of water.

Lime and sulphur wash (10 pounds of sulphur and 5 pounds of quicklime mixed in 5 gallons of water)—dilute about 7 times to destroy scale insects or fungus.

Bordeaux mixture (4 pounds of quicklime and a like quantity of copper sulphate in 50 gallons of water)—one of the best fungicides; has the advantage of being cheap.

Copper carbonate solution (1 ounce of copper carbonate dissolved in ammonia and mixed with 9 gallons of water)—used on ornamental shrubs and ripening fruits instead of Bordeaux mixture, because it leaves no stains upon the plants.

Nicotine sulphate solution (40 drops to each quart of water) is another useful spray.

Pyrethrum powder—may be mixed with kerosene as a spray or included in dusting preparations. Recommended for destroying aphids.

Rotenone—extracted from the roots of certain tropical plants. Because it is not poisonous to human beings, it is a desirable substitute for the arsenic sprays and dusts. Powerful; sprays and powders of one per cent are effective.

SPRING. When ground-water (water which has sunk beneath the ground) issues from beneath the surface through a natural opening in sufficient quantity to make a distinct current, it is called a spring. In general, springs are due to the accumulation of water underground in porous rock or soil. Outlets may occur in a valley or upon a hillside. In a valley, they occur where the land dips below the level of the ground water; and on a hillside, where the water runs along the slope of a bed of rock or clay to a place where the bed "outcrops" or comes to the surface. Should the water be caught under an impervious layer of rock or soil, it will be under pressure. If then it finds an opening it spurts out as an *artesian* spring. If the opening is man-made, it is called an artesian well (*see* Artesian Wells). Permanent springs are usually those that rise from a great depth. Many springs are intermittent. Springs of very great flow may indicate the existence of subterranean rivers.

Some hot springs are found near volcanoes. Others, far distant from volcanoes, consist of water which has sunk to great depths, where it has been warmed by the hot rocks below and then forced back to the surface. A hot spring which throws out columns of water and steam is called a geyser (*see* Geyser).

Many springs, both hot and cold, contain large quantities of mineral salts in solution. These often become health resorts and fashionable "watering places," such as Spa, in Belgium (where the use of the name "spa" for such a resort originated). Other examples are Baden, Karlsbad, and Marienbad, in Germany; Bath, England; Hot Springs, Ark.; Saratoga Springs, N. Y.; Hot Springs, Va.; French Lick, Ind.; and White Sulphur Springs, W. Va.

SPRINGFIELD, ILL. The capital of Illinois will ever be a place of pilgrimage for admirers of Abraham Lincoln. Here he lived during the 25 years preceding his election as president. And here, in a beautiful mausoleum in Oak Ridge Cemetery, his body is entombed. The house in which he lived and his tomb are the property of the state. In the old Statehouse, now the Sangamon County Courthouse, he served as legislator and argued cases before the Supreme Court. His famous "house divided" speech was made in the present circuit court room. About 25 miles northwest is the restored village of New Salem, where he lived for six years before coming to Springfield.

The city is nearly in the center of the state, on the Sangamon River. It is the trading center of a

farming and coal-mining region, and manufactures boilers, electric meters and time clocks, road machinery, plows, tractors, shoes, soy bean and wheat flour.

The Capitol stands in a nine-acre plaza, flanked by the Supreme Court Building, Archives Building, State Armory and Office Building, and Centennial Building. The last houses the State Historical Library, Museum, and Art Gallery. Lake Springfield, the city reservoir, is the chief recreational area. On its shores is the Lincoln Memorial Garden. The artistic Vachel Lindsay Bridge is a memorial to the poet, who was a native of the city.

Springfield was settled in 1819 and became the state capital in 1837. Population (1940 census), 75,503.

SPRINGFIELD, MASS. Two travelers, an Englishman and an American, were looking out over the Rhine Valley from the tower of the Strasbourg cathedral. "Have you ever seen anything more beautiful?" exclaimed the American. "Only once," said the Englishman, "from the top of the tower in Springfield, Massachusetts, looking over the Connecticut Valley to the Berkshires." "Why," said the amazed American, "I live in Springfield, but I have never seen that view."

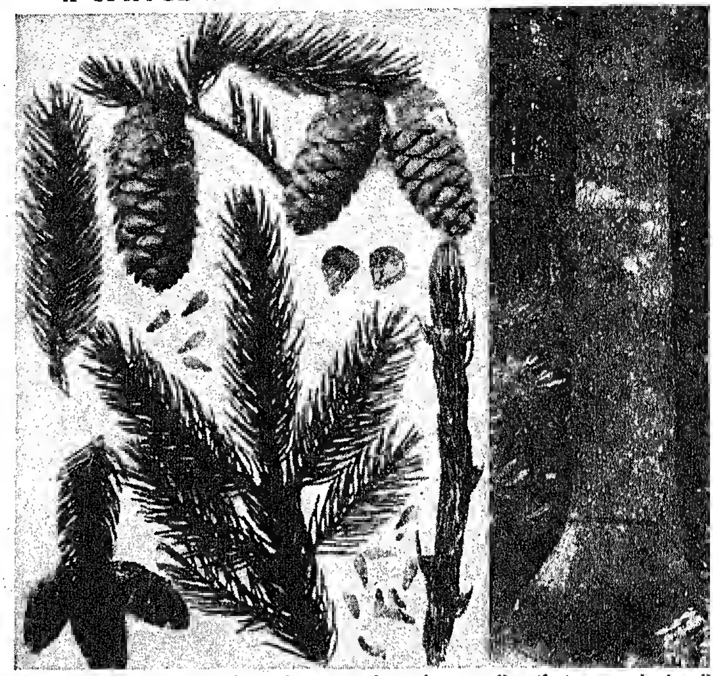
A campanile tower 300 feet high commands this wonderful view over the Berkshires. The tower is flanked on either side by identical buildings of classical design, the auditorium, and an administration building, comprising the notable Municipal Group (*see* City). Several cultural institutions are grouped about a large rectangular court farther north. Here are the Public Library, the Museum of Natural History, the Museum of Fine Arts, and the George Walter Vincent Smith Art Museum. The William Pynchon Memorial Building is the home of the Connecticut Valley Historical Society. In Merrick Park, adjoining the Public Library, is Saint-Gaudens' statue of 'The Puritan'. The Church of the Unity and the County Courthouse are notable buildings designed by H. H. Richardson. Springfield is the seat of the International Y.M.C.A. College and the American International College.

Springfield has manufactured firearms since the United States Arsenal was established here during the Revolution, and the United States Armory in 1794. The Springfield and Garand army rifles were designed in this arsenal. Smith and Wesson firearms are also famous. Other products include electrical apparatus, motorcycles, toys and games, matches, machinery, and machine tools. Webster's Dictionary has been published here since 1843.

Under the leadership of William Pynchon, Springfield was first settled in 1636. In 1675, during King Philip's War, it was burned by the Indians. It was the scene of riots during Shays' Rebellion (1786–87). The *Springfield Republican*, established by Samuel Bowles in 1824, is one of the most influential newspapers in New England. Population (1940 census), 149,554.

SPRUCE. The home of the spruces is from the Arctic Circle south to the Himalayas of Asia, the Pyrenees of Europe, and the Appalachians and the Rockies of North America. These cone-bearing evergreen trees, of which there are about 40 species, make up the genus *Picea* of the pine family. In stands, the trunks are usually clear of branches for about 50 feet and have conical crowns. Growing singly, they are generally shaped like a pyramid, the lower branches often touching the ground, the upper ones tapering up to a point.

A SPRUCE AND ITS DISTINGUISHING MARKS



Like the other spruces, the red spruce above has needles that grow singly all around the branches, not in clusters, like the pines. You can tell a spruce from a fir by its sharp, stiff, four-sided needles. Fir leaves are blunt, soft, and flat. Spruce cones hang down; fir cones stand erect.

The species vary considerably in size. Some are small or medium-sized trees from about 50 to 100 feet high; others soar to more than 200 feet. Spruces grow best in moderately moist, sandy soil, with some protection from the sun. They are long-lived trees. In favorable locations some live for more than 400 years.

Because of their symmetry and thick foliage, spruces are valued for ornament. For planting in parks and gardens they are sometimes dwarfed by pruning. They are used for windbreaks and make excellent hedges, being dense and durable if trimmed regularly.

The most important North American species are the white spruce, the black spruce, the red spruce, the blue or Colorado spruce, the Engelmann spruce, and the Sitka spruce. The last three are found chiefly in the western part of the United States and Canada.

The finest European species is the Norway spruce, which is planted in North America as an ornamental tree. From Norway and Sweden, where it is most abundant, the lumber is shipped throughout Europe.

Commercially, spruce wood is very valuable. It is unusually light for its strength, easy to work, and has a high degree of elasticity. It is the chief wood from which paper pulp and rayon are manufactured. In shipbuilding, masts and spars are made of it. It is also used for boxes and crates, general building purposes, and parts of airplanes. Because of its resonant quality, it is the finest wood for the sounding boards of musical instruments.

SQUASH. Squashes, pumpkins, and gourds belong to one big puzzling family. Gourds, with their white blossoms and hard inedible fruit, are easily identified; but pumpkins and squashes, cultivated so extensively for the thick-fleshed edible meat, have become badly confused.

L. H. Bailey, in his 'Lessons with Plants', tells how we can distinguish between a pumpkin and a squash by a glance at the stem. If it is ridged and furrowed, or if it flares at the point where it joins, the fruit is a pumpkin, but if it is soft, spongy, and cylindrical, not enlarged at the junction, it is the stem of a squash. You will find by applying this classification that many fruits we have always known by the name of "pumpkin" are really squashes, and many we have called "squashes" are pumpkins.

If the name squash belongs to one group more than another it is to *Cucurbita maxima*, to which species belong the Hubbard, Marblehead, Sibley, and Turban squashes. The field or common pie pumpkin is *Cucurbita pepo*. The "vegetable marrow," so highly prized in England, and also the "summer squashes"—the Scallop, Pattypan, and the Crookneck types—are all varieties of the pumpkin species. On the other hand, the Cushaws, Canada Crooknecks, Japanese Crooknecks, Dunkards, and "sweet potato" squashes belong to still another species (*Cucurbita moschata*), and are probably native to Asia. In England all varieties of pumpkins, squashes, and gourds are often called "gourds." (*See* Gourds.)

SQUID. A mollusk of the cuttlefish family, with ten arms or tentacles bearing suckers. Usually squid are small, and they are much used for bait by North Atlantic fishermen. The giant squid, which is the "octopus" or "devil fish" of fiction, sometimes attains a length of 55 feet and a weight of 1,000 pounds. An observer on a whaling ship describes a deadly conflict which he witnessed between a large sperm whale and a giant squid almost as large as itself, whose interminable tentacles seemed to enlace the whale's whole body. The latter's head, especially, seemed a network of writhing arms and it appeared to have the tail part of the squid in its jaws and to be sawing through it in a business-like methodical way. The black eyes of the squid, which contrasted with the livid white head, were at least a foot in diameter. (*See* Cuttlefish, Squid, and Octopus.)

SQUIRREL. Among our wild animals none are better known than these pretty bright-eyed graceful little creatures, which are now as common in city parks as in the forests and country places.

A FLYING SQUIRREL AT REST

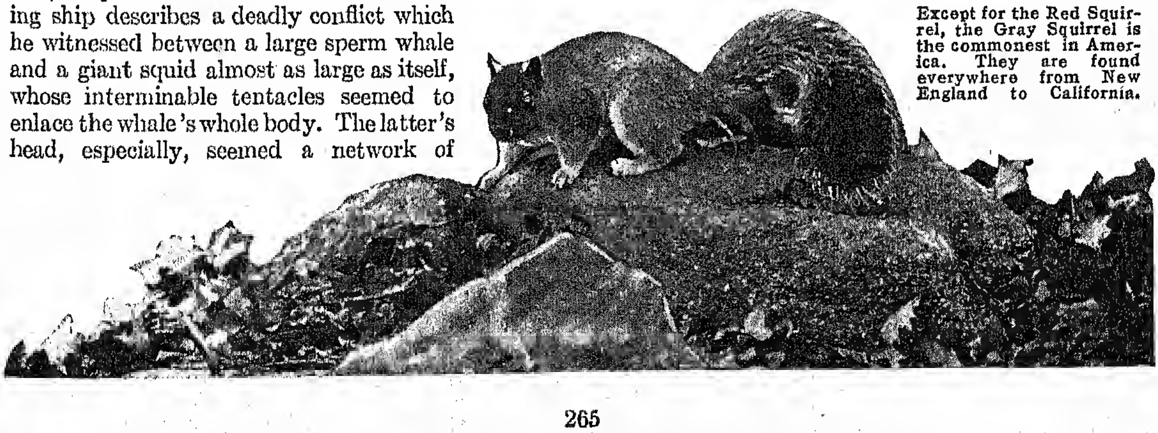
This Flying Squirrel is just about to leap. Notice how prominent his hind leg is. When he starts to leap he spreads his legs apart, forming a sort of parachute.

Laws have been passed to protect them; children, older people, and even dogs have learned not to molest them; and as a result the squirrels have come to trust us and are among our best friends.

The squirrel, as he frisks up and down the trees, chattering gaily, is the cheeriest of companions. If you try, you can coax him up to you by holding out to him a nut or other bit of food. At first he may scamper away as soon as he gets the nut. But when he comes to know you, he will sit up on his haunches before you to eat it, handling it adroitly with his fore feet and cutting through the shell with his sharp teeth. In time he may even become bold enough to help himself out of your pockets.

Some member of the squirrel family may be found in almost any part of the world except Australia. The numerous species, which belong to the order of rodents, or gnawing animals, fall naturally into two great divisions—the ground squirrels and the tree

THE FRIENDLY LITTLE GRAY SQUIRREL



Except for the Red Squirrel, the Gray Squirrel is the commonest in America. They are found everywhere from New England to California.

squirrels. The ground squirrels include the groundhog or woodchuck, the prairie-dog, the striped gophers, and the chipmunk, which are described in separate articles.

A SQUIRREL AVIATOR "TAKING OFF"

This Flying Squirrel is just setting sail, or in the technical language of aviators, is "taking off." When fully spread out he covers so much area that the atmosphere nearly supports him.

There are several varieties of tree squirrels, differing in size and color, but all having the characteristic slender agile body and long bushy tail. They live in the trees, building their nests either in the branches or in hollow trunks. They feed mainly on acorns and nuts, but occasionally eat animal food and birds' eggs.

The red squirrel, so called from its rusty red color, is the smallest of the tree squirrels. It is not more than eight inches long, with a tail of six inches or less. It is found in most of the wooded parts of North America north of Mexico, and is common in the forests of Canada and the northeastern United States. The red squirrel is the liveliest, the noisiest, and also the most mischievous of the squirrels. In New York and New England it often quarrels with its neighbor the gray squirrel, and is even known to drive these rivals out of a grove. It also has the bad habit of robbing birds' nests and eating the eggs and young.

The Douglas squirrel of British Columbia, Oregon, and California is a relative of the red squirrel. Besides its scolding chattering notes it has a real song. The upper parts of the body are dark brown and the lower parts are lighter and of a more reddish cast.

The gray squirrel is perhaps the best known of the North American squirrels. It ranges from Nova Scotia to Florida and westward to the treeless plains. It is nearly twice as large as the red squirrel and is more graceful in build. The color is mainly gray, often with a brownish or rusty tinge, and sometimes almost black. Friendly and active and merry, the gray squirrel is a general favorite.

Fox squirrels are larger and heavier than the gray squirrel. They vary greatly in color. The rusty fox squirrel inhabits the upper Mississippi and Ohio valleys. The Southern fox squirrel is grayish brown with pure white nose and ears.

The squirrels of Europe, though similar in color and in some other characteristics to the American species, are not closely related. The skins of the gray squirrel of Russia and Siberia are much used for fur, and this is the only squirrel fur that has commercial value.

The most remarkable of all the squirrels is the flying squirrel, which is found in temperate and tropical regions in various parts of the world. It has a peculiar extension of loose skin connecting the fore and hind legs, which is drawn out to form a parachute when the legs are extended. Thus the animal can take long sailing leaps from higher to lower branches in trees, sometimes covering nearly 20 yards. Two species inhabit eastern North America, one bluish-gray and about 13 inches long, and the other larger and glossy brown. There is also an "alpine" species which inhabits the high slopes of the Rockies.

Scientific name of red squirrel, *Sciurus hudsonicus;* of Douglas squirrel, *Sciurus douglasi;* of gray squirrel, *Sciurus carolinensis;* of fox squirrel, *Sciurus niger;* of flying squirrel of eastern United States, *Sciuropterus volans.*

STALIN, JOSEPH V. (born 1879). The dark, silent man who succeeded Lenin as head of the Soviet Union was little known outside Russia before 1928. Then his victory over Trotzky brought the name of Stalin before the world (*see* Trotzky, Leon). To the world he remained a mystery even after he became general secretary of the Russian Communist Party, but the poor in Russia had long known him as a leader.

Stalin's real name was Iosif Vissarionovich Djugashvilli. He was born in Georgia, the son of a shoemaker. Until the boy was 13, he lived among the poorest people. Then he was sent to a seminary to study for the priesthood. He found books with ideas on government and property which led him to believe that a revolution was needed to better conditions in Russia. Expelled from school for influencing other students, he began at 19 to organize groups of peasants and factory workers. He often went days without food or sleep, but he managed to give talks, print leaflets, and even edit newspapers. Exiled five times, he quickly escaped each time and renewed his activities.

The revolution of 1917 freed him from his sixth exile, and when the Bolshevist party came into power he became one of Lenin's most loyal associates. His years of hardship had earned for him the name Stalin (steel). After he became dictator of the Soviet Union, Stalin continued to live modestly, dress simply, and work 16 or 18 hours a day. When anyone called him the successor of Lenin, he quickly replied, "No, only his disciple." (*See* Lenin, Nikolai; Russia.)

A POPULAR HOBBY *that has Become a* SCIENCE

The power of a wafer . . . to guard a letter as it flies over sea, over land, and comes to its address as if a battalion of artillery brought it, I look upon as a fine meter of civilization.

—Emerson, in his Essay on "Civilization"

STAMP AND STAMP COLLECTING. When you see a strange stamp on a letter do you examine it carefully? If you are not a stamp collector, perhaps you may pass it by without realizing that it has a story to tell. It would take pages just to list the dramatic stories that are found on postage stamps—geography stories that lead one into strange places and among strange peoples; history stories of exploration and rulers and stirring events; stories of science and invention, of art and archeology, of industry and transportation. Hence stamp collecting has become one of the most popular of hobbies. And with many collectors it has become far more than a pastime. It has grown to be a science and a life study.

Most collectors are interested in postage stamps only and do not collect other kinds, such as tax or revenue stamps. Postage stamps are, to the collector, only those stamps used to show that the postage—that is, the charge for forwarding a letter or a package—has been prepaid. There are three kinds used today: the pieces of gummed paper that we stick on envelopes; the stamps printed or embossed directly on envelopes, like a seal; and the imprints that are stamped on envelopes with an inked dye at the time of mailing.

Adhesive stamps came into use in the early 1840's, and it was soon after this that stamp collecting began. The history of postage stamps, however, really begins two centuries earlier. In 1653 a Frenchman, M. (afterward Comte) de Villayer, after obtaining a concession for delivering local mail in Paris, devised a marked wrapper which his agents sold for two sous (about two cents). He set up mail boxes in which letters contained in these wrappers could be posted, to be collected and delivered by his carriers. But the post was not a success and de Villayer's scheme for showing prepayment of postage was soon forgotten.

It was not until 1839–40 that Rowland Hill, an English schoolmaster, prevailed on the British government to adopt a plan for the prepayment of postal fees through the use of stamps.

Hill proposed one- and two-penny letter sheets, one- and two-penny stamped envelopes, and small one- and two-penny labels ("with a glutinous wash on the back") to be bought and affixed to letters at the post-

SOME ATTRACTIVE STAMPS AND SOME RARE ONES

Here are some of the stamps that collectors covet: (1) the first adhesive stamp, the "penny black" of Great Britain, used in 1840; (2) the famous 1-cent British Guiana rarity, only one of which is known and which once changed hands for $32,500; (3) the City Despatch Post stamp, issued in New York in 1842; (4) the New York Postmaster stamp of 1845, the forerunner of the United States stamps; (5) the smallest individual stamp, issued in Bolivar, Colombia, in 1863; (6) heraldry: the arms of the free city of Hamburg on a stamp issued before the city was included in the German Empire; (7) a German stamp overprinted for use in Poland in 1916 and overprinted and surcharged by the new Polish government in 1918; (8) the Cape of Good Hope Triangular stamp of 1853, one of the most popular stamps of the 19th century; (9) animal life on a stamp of Liberia; (10) invention: Leonardo da Vinci's flying machine shown on an Italian stamp; (11) exploration: a French stamp in honor of Jacques Cartier; (12) Boy Scout on a stamp of Rumania; (13) a bisect: half of a 4-cent stamp used as 2 cents, Danish West Indies; (14) one of a series of German stamps commemorating the story of transportation. Notice that some of the stamps above are canceled, others are not. Usually uncanceled stamps are more valuable, but there are important exceptions to this rule.

office. After wide advertisement these three types were issued to the public on May 6, 1840. The letter sheets and envelopes—which came to be called "Mulreadys" for William Mulready, a well-known London artist who designed them—were received as a sort of joke and were laughed out of existence in a few weeks. The little gummed labels, on the other hand, were well received. They are our first adhesive postage stamps. Eighteen months before these stamps appeared, Sydney, in New South Wales, had adopted part of Hill's scheme and had issued letter sheets bearing embossed stamps for local use.

In the United States, local mail at this time was frequently handled by private agencies; and it was one of these, Blood's Despatch, a city post of Philadelphia, that in 1841 issued the first stamps in the United States. The following year Alexander Grieg established the City Despatch Post in New York City and issued stamps of 3-cent denomination for local delivery. His post drew so much business from the New York Postoffice that the government bought it the same year and continued it as the United States City Despatch Post, issuing stamps under that name for several years.

In 1844 several private letter expresses for intercity delivery began issuing their own stamps, and in 1845 a number of American postmasters joined these agencies. The New York Postmaster's Stamp was issued at the suggestion of the postmaster general to try out the use of stamps. Supplies were sent to Boston, Albany, Philadelphia, and Washington for this purpose, and stamps exist with cancellations from these and other cities. The first United States Government issue, authorized by act of Congress, appeared in 1847.

Between 1840 and 1850 a number of foreign countries and cities began to issue stamps. The number grew rapidly until soon every important country and colony in the world had its stamps.

THE FAMOUS MAURITIUS STAMPS ON A COVER

This is considered the finest philatelic piece in the world. It shows the one-penny and two-penny "Postoffice" Mauritius stamps of 1847 on a cover, the only one of its kind known. It was sold at auction in London in 1935 for $25,000.

The Beginnings and Growth of Stamp Collecting

Soon after the use of stamps became established, collecting them became a hobby. Today more than two million people in the United States are working on stamp albums. The hobby is encouraged in the schools, not only for its value in stimulating interest in various fields of knowledge, but for the training it gives in classifying materials and arranging them in an orderly fashion, and, more important, for its worth as a social activity. The organization of collectors' clubs usually accompanies a wave of interest in collecting stamps, and many a fast friendship has resulted from trading stamps.

By 1860 stamp collecting had advanced to a point where dealers were sending out lists of stamps for sale. The first list is credited to Oscar Berger-Levrault of Strasbourg. Alfred Poliquet issued the first catalog in Paris in 1861. He was followed in 1862 by Mount Brown of London, who listed 1,200 varieties, and by A. C. Kline of Philadelphia later in the year. The first album with spaces for stamps, the work of Justin Lallier, appeared in Paris and London in 1862 and its use quickly spread to America. In the same year a stamp paper 'The Monthly Intelligencer' appeared in England, followed in 1863 by the 'Stamp Collector's Magazine', the first English monthly of permanent worth. In the latter year magazines were also established in Belgium and Germany. S. Allen Taylor, in 1864, began the 'Stamp Collectors' Record', the first American stamp paper, which was published for ten years. The Scott Stamp and Coin Company, publishers of the 'Standard Postage Stamp Catalogue' used throughout America, dates back to 1860.

Because there are so many kinds of postage stamps—there are nearly 90,000 government issues, it is estimated—collectors have been forced to specialize. A collector may concentrate on rare stamps, historical pageants on commemorative stamps, a geographical study from stamps bearing maps, or any one of a hundred subjects.

How Stamps Are Identified

For some years after collecting began no attention was paid to dates of issue, kinds of paper, watermarks, method of printing, perforations, or other variations. Then, in 1867, Berger-Levrault began the study of such features, and collectors, following his lead, began to use these valuable aids in distinguishing different kinds of stamps and different issues. The principal printing methods used for stamps are engraving, lithography, typography, and photogravure (*see* Engraving). Before 1854 sheets of stamps had to be cut apart, but since the invention of the perforating machine in that year by Henry

Archer in Ireland, sheets have usually been pierced so that the stamps can be easily pulled apart. When little cuts are made with a toothed wheel without the removal of any paper, the process is called "rouletting"; when the paper is cut away by punches to form a line of small holes, the stamps are said to be "perforated." The shape and the frequency of the piercing may help to distinguish two stamp issues that otherwise resemble each other. Thus a stamp may be designated in a catalog as showing a "saw-tooth roulette," meaning that the cuts form a zigzag line; another stamp will be listed as "perf. 12½," meaning that it shows 12½ perforations in a two-centimeter length.

The cancellation of a stamp often affects the value, particularly of an old specimen. In general the older stamps are more valuable if they are on the original covers, particularly if these bear rare route markings of historical interest, such as "Per Pony Express." The condition of a stamp also affects its value. Unused stamps should be "mint," that is, in postoffice state, with the original gum.

Rare stamps, known as "rarities," are stamps of which only small numbers were issued or stamps on which errors occur. A sheet of the 24-cent United States red and blue airmail stamps of 1918 was printed with the airplanes upside down. The sheet of 100 stamps was bought at a postoffice window for $24. Copies of the stamp have since sold for $3,500.

The greatest private stamp collection of all time was that of Baron Philip von Ferrari, an Austrian who died in Lausanne in 1917. Later the French government seized and sold his collection for about $2,000,000. The Hind collection, the finest ever assembled in America, brought $875,000 in a series of auction sales from 1933 to 1935.

The Collectors' Club of New York is the leading collectors' organization in the United States. Other American organizations are the American Philatelic Society, the Society of Philatelic Americans, and the National Federation of Stamp Clubs.

How to Begin a Stamp Collection

The best way to begin a stamp collection is to buy from a dealer one of the many inexpensive packets of stamps containing several hundred varieties. You may then add to your collection by exchanging with fellow collectors; by the purchase of sets of stamps; by selection from dealers' approval sheets; by sending lists of stamps wanted to dealers; or by buying at auction sales, which are held in almost every large American city several times monthly. Philatelic agencies which sell current stamps at face value have been established by several governments. The United States agency is located in the Postoffice Department Building at Washington, D. C.

Albums with either printed or blank pages may be procured. The latter kind is preferred by collectors who are specializing and desire to add explanatory notes. The best way to attach stamps to album pages is by gummed paper hinges which can be removed without injury to the stamp. Pamphlets containing full instructions for handling and mounting stamps may be obtained either free or at small cost from dealers.

Some good books on stamp collecting are listed in the article Hobbies. For American collectors, there are besides Scott's Standard Catalogue, 'The Standard Catalogue of Airport Stamps', by Nicolas Sanabria; and 'United States Stamp Catalogue', by the Scott Stamp and Coin Co. Among the stamp periodicals are 'Stamps', 'Mekeel's Weekly Stamp News', and 'Weekly Philatelic Gossip', all weeklies; and 'The American Philatelist', 'Stamp and Cover Collecting', and 'Scott's Monthly Journal', monthlies.

The name philately (*fĭ-lăt'ĕ-lĭ*), universally used for the science of stamp collecting, was adopted in 1864 after considerable discussion. It is a combination of two Greek words meaning "love of tax-free things (i.e. prepaid)." A philatelist is one who by his study or writing has added to the knowledge of stamps, as distinguished from the collector, who merely accumulates them.

STAMP ACT. The French and Indian War (1754–63) doubled the debt of the British government, and at the same time greatly increased British possessions in America. The British government therefore decided to station British troops in the colonies to prevent the French from recovering Canada, and also to defend the colonies against the Indians. Most Englishmen thought it only right that the colonies should help pay for the support of these troops. For a partial support of the troops the British Parliament therefore passed the Stamp Act in 1765. This provided that stamped paper (*see* illustration), purchased of the British government, should be used for all important documents, including newspapers.

The cause of the trouble.

This tax aroused great opposition among the colonists, partly because they thought they should not be taxed except by their own representatives, partly because they opposed the presence of British troops, and partly because the tax had to be paid in silver and thus would carry away so much of their money that it would seriously interfere with business. Benjamin Franklin, who was in England at the time, advised his countrymen to submit to the law until they could get it repealed. But a "Stamp Act Congress," representing nine colonies, met in New York City on Oct. 7, 1765, and declared that only the colonial assemblies should tax the colonists, and so paved the way for resistance. When the stamped papers began to arrive, mobs seized them, or forced the ships' captains to take them back to England. They also forced stamp commissioners to resign, so that even where the stamps were landed there was no one to distribute them.

Many officials and wealthy merchants were in favor of stopping all business which required the use of stamped papers. "Let the courts close," they said. "Let the ships lie in the harbor. Let the merchants stop importing any British goods. Let the printers stop printing newspapers." This, they said, would be perfectly legal, and it would so seriously interfere with the business of British merchants that Parliament would be forced to repeal the law. But the printers and lawyers, the small shop-keepers and laborers, who would be reduced to distress if business stopped, wanted to disregard the Stamp Act entirely. These called themselves "Sons of Liberty," and denounced the more conservative people.

Both methods of resisting the law were employed to some extent. The printers went on printing news-

papers. A good deal of trade was carried on without stamped clearance papers. The courts did some business without stamped papers. But the higher courts were closed much of the time; and the merchants formed an agreement not to import British goods, which was pretty well observed. In general there was a marked interference with business, and the poorer classes suffered greatly in the winter of 1766 for want of employment; with the result that rioting and disturbances were common.

This resistance helped to bring about the repeal of the law. Certain men in Great Britain, notably William Pitt, came to the assistance of the Americans. The British merchants, whose trade was seriously cut, pressed for the repeal of the act. In addition there was a change in the ministry, and the new ministers from party reasons were disposed to condemn the action of their opponents. The result of all of these influences was that the Stamp Act was repealed in March 1766. This step, however, was accompanied by a "declaratory act" setting forth Parliament's supreme power over the colonies in matters of taxation, as well as in all other matters of legislation. (*See* Revolution, American.)

STANDISH, Miles (about 1584–1656). When the Pilgrims were living in Leyden they were joined by Miles Standish, an English soldier who had been fighting in the Low Countries. In 1620 he and his wife Rose sailed on the *Mayflower* on its famous voyage to the New World. What led this military man to cast his lot with this little band will never be known; he was not one of their congregation, yet he was destined to be one of their leaders.

The Plymouth colonists soon saw that Standish's army life had been the best possible preparation for the military leadership of the colony and they made him their captain. Into his charge were given all matters of fortification and expeditions against the Indians. When the *Mayflower* cast anchor in Plymouth Bay, we are told, Standish and 16 men, "with every man his musket, sword, and corselet," set out to explore the country along the shore "marching in a single file." Little wonder that the half-dozen Indians who saw this armored procession advancing "ran away with might and main."

No one in the colony understood the Indians as did Standish. When Chief Corbitant kidnapped the colonists' interpreter and friend, Squanto, he promptly marched to the Indian village with a little company of men, rescued the captive, and brought him triumphantly back to the settlement. He knew that what the little body of white men lacked in strength they must supply in quickness and determination. In strange contrast to the bluff man of arms we see in these deeds is Bradford's picture of the Captain during the terrible winter of 1620–21, during which Rose Standish died. He went about from cabin to cabin doing whatever was most needed; cooking, washing clothes, or nursing the sick, with all the tenderness imaginable.

A charming tale of the wooing of Priscilla Mullins is told by Longfellow in 'The Courtship of Miles Standish'. Whether or not this story be true, we do know that Captain Standish later married a young woman who came over in the *Ann*. They and their children lived happily across the bay from Plymouth at Duxbury, a settlement founded by a group of colonists from Plymouth.

STANLEY, Sir Henry Morton (1841–1904). "The river was calm, and broad and brown. Armies of parrots screamed overhead as they flew across the river; legions of monkeys sported in the branchy depths; howling baboons alarmed the solitudes; crocodiles haunted the sandy points and islets; herds of hippopotami grunted thunderously at our approach; elephants bathed their sides by the margin of the river; there was unceasing vibration from millions of insects throughout the livelong day; from the shores came the unearthly cry of the relentless cannibals." So wrote the explorer Stanley, of the Congo River in Africa when, the first white man to see these scenes, he descended 2,000 miles of its great extent to its mouth. Far in the interior he had embarked on its waters, without knowing what river it was or where it would lead him. Livingstone, who had discovered the stream near its headwaters, thought it was the Nile because it flowed northward. But Stanley found that presently the river turned westward, and he began to suspect that it might be the Congo, whose mouth on the west coast was already known.

Stanley had entered Africa from the east coast, from Zanzibar, so that when he arrived at the Congo's mouth he had made the complete crossing of this equatorial belt of Africa from east to west, opening up this vast region to the world. The expedition took three years (1874–77), and cost the lives of all three of his white companions, and of many natives.

The results of this expedition were enormous, for it led directly to the formation of the Congo Free State and the exploitation of the region. Stanley himself, after England had refused to interest herself in the new territory, went back to Africa and under the patronage of King Leopold of Belgium, head of the Congo state, took charge of opening the country to commerce, establishing trading posts and river navigation. The great abuses which sprang up later under Leopold's rule were in no way Stanley's fault, as he was throughout the friend of the natives and worked for their good.

Stanley's interest in equatorial Africa had been first aroused some years before, when as a newspaper correspondent he undertook an assignment from the New York *Herald*. "Go find Livingstone," said James Gordon Bennett, the publisher of that paper, to him in Paris. The great missionary explorer David Livingstone had at that time been lost to sight in the interior of Africa for five years. Almost everyone thought him dead. Stanley set out from Zanzibar for the interior on March 21, 1871. After conquering almost insuperable difficulties and trav-

eling for nearly eight months he came to an Arab town named Ujiji on Lake Tanganyika. He had heard rumors from the natives that a white man with a white beard was in this town, and he marched into it between hope and fear. Good fortune was with him, for he found Livingstone, old, ill, and with scanty supplies. When he actually saw before him the great man for whom he had been searching so long, all young Stanley found to say was, "Dr. Livingstone, I presume!"


HENRY M. STANLEY

Stanley stayed in Ujiji four months and became a devoted admirer of Livingstone, but was unable to persuade him to leave his work and return to civilization. After the old missionary's death Stanley determined to continue his work of exploring the interior of Central Africa. The expedition down the Congo was the result.

Stanley's life throughout was a curiously adventurous one. His name was originally John Rowlands and he was born in Wales. After a youth of extreme poverty, he ran away to sea and landed in New Orleans, where he was adopted by a merchant named Stanley, whose name he took. He fought with the Confederate army in the Civil War, was for a time in the United States navy, and later became a newspaper correspondent. In this capacity he traveled in Asia Minor, and accompanied an expedition under General Hancock against the Indians in the West, a British expedition against the emperor of Abyssinia, and still a third, also British, to Ashanti on Africa's west coast.

After Stanley had established navigation on the Congo he made still another expedition across that continent. This time he traveled from west to east, ascending the Congo and cutting across the vast tropical forest to Lake Albert. The object of this last expedition was to rescue Emin Pasha, a German agent of the Egyptian government who was cut off in equatorial Africa by a native uprising. With Emin, Stanley arrived at Zanzibar, the point of departure for his earlier expeditions, in December 1889.

This expedition ended Stanley's active career in Africa. His later years were spent in England, where he again became a British subject, was elected to Parliament, and was made a knight. No man did more to open up the interior of Africa to knowledge and civilization, and few have had a more romantic or adventurous career than this poor orphan boy who was honored at his death with a public funeral in Westminster Abbey.

Stanley's writings include: 'How I Found Livingstone' (1872); 'Through the Dark Continent' (1878); 'In Darkest Africa' (1890); 'My Dark Companions and Their Strange Stories' (1893); 'My Early Travels and Adventures in America and Asia' (1895); 'Through South Africa' (1898); 'Autobiography' (edited by his wife, 1909).

STANTON, EDWIN MCMASTERS (1814–1869). The task of administering the War Department of the American government through the Civil War fell to Edwin M. Stanton; to him was given the handling of thousands of men and millions of dollars at a time when the very existence of the country depended on men and money.

The man who bore this great responsibility began life as a lawyer in Ohio and an anti-slavery Democrat. He had attended Kenyon College, in Ohio, and then studied law, being admitted to the bar in 1836. For a time he practiced law, first in Steubenville, Ohio, and then at Pittsburgh, Pa. While still practicing in Ohio he met Lincoln as an associate in one of his cases, and disdainfully inquired, "Where did that long-armed creature come from, and what can he expect to do in this case?" As Stanton's practice before the United States Supreme Court increased he moved to Washington, in 1856. In 1860 he was appointed attorney-general by President Buchanan. He was violently opposed to Lincoln in 1860, and referred to him as the "original gorilla." He retired from office at the end of Buchanan's term.

In spite of his opposition to Lincoln and to the Republican party, and in spite of his remarks concerning the "painful imbecility of Lincoln," the new President offered him the place of secretary of war in 1862. He accepted the position, as he honestly said, "to help save the country."

Stanton was of a tactless disposition, and hard to coöperate with. But Lincoln managed to "plow around him," though at times the President found it "necessary to put his foot down firmly," as when he insisted that the proportion of troops to be furnished by New York in 1864 was too high, and that Stanton should reduce the quota by 9,000.

In spite of frequent differences of opinion Lincoln recognized Stanton's ability. When pressure was exerted to induce him to remove the unpopular secretary from office, he replied, "If you will find another secretary of war like him, I will gladly appoint him." In the meantime Stanton's estimate of Lincoln had undergone a radical change. At Lincoln's death Stanton said, "There lies the most perfect ruler of men the world has ever seen."

After Lincoln's assassination Stanton continued to hold his position under President Johnson, until 1868. His relations with Johnson were never pleasant, and finally the President sought to remove him from office. This attempt led to the impeachment of the President (*see* Johnson, Andrew). When the proceedings against Johnson failed, Stanton resigned and returned to the practice of law.

The next year he was appointed by President Grant to the United States Supreme Court, but he died four days after the appointment was made. Though the country recognized Stanton as an able administrator, he was generally disliked for his overbearing manner and his sharp tongue, which on more than one occasion changed a friend into an enemy. As time goes on and his abrupt ways are forgotten, the value of the services which he rendered in those troubled years is more and more clearly understood.

What immensities of space and what myriads of stars appear in this picture, taken at Yerkes Observatory, of the Milky Way where it crosses the northern constellation Ophiuchus or Serpentarius! In many places the stars are thick enough to look like a glowing cloud, instead of separate points of light. Notice also the dark places, or "holes." They are not empty spaces, but dark nebulae—clouds of matter which does not give off light. Truly here are mysteries which challenge understanding.

STAR. On any clear night, we can see the glorious array of stars spread above us in the sky. They seem to be tiny, twinkling points of light, save for a few that stand out like bright lamps.

What are these stars? How far away are they? Why are they always arranged in the same patterns (called *constellations*), night after night, year after year, and century after century? For ages men have asked such questions, and for ages their only answers were fanciful tales. Today, thanks to the telescope and other aids, astronomers can answer some of these questions completely, and others at least in part.

Nature of the Stars

Why the stars seem to move is explained in the article on Astronomy. Next we want to know what a star is. Astronomers tell us that every bright star is a sun, like our own sun that brings daylight every morning. This means that such a star is a huge globe of glowing gas, so hot that steel placed in it would vanish into a puff of gas!

In many stars, the gases may be unbelievably thin. The particles or atoms of matter in the gas are far enough apart to make the gas a thousand times less dense than the air we breathe. Yet matter *is* there, perhaps a million times as much as we have in the earth, for all its thinness. Hydrogen and oxygen are there, and nitrogen—perhaps iron too, and calcium. In cooler stars, the matter may be more nearly liquid, more like the boiling iron in a blast furnace; and in some old and comparatively cold stars, the matter may be packed so densely that a cubic inch of it would weigh a ton. Such stars we call "dead" or "dark."

How do astronomers know all this? They learn these facts with spectroscopes. With these instruments they can tell, from the light a star gives, what kinds of matter it contains and how hot it is. How do we learn about dead stars that give no light? Some of them we detect because they are near bright stars, and gravitation keeps the two swinging around each other. From the motion of the bright star, astronomers can calculate the nature of the dark one. In some such double stars, or *binaries*, the dark one swings regularly in front of the bright one, and cuts down the light. Such a pair is called a *variable star*, or *eclipsing binary*. Still other dark stars give off infrared radiation. This is not visible to the eye, but it can be photographed on special plates.

The Number of Stars

The picture above gives us some idea of the enormous number of stars. The naked eye can see from 4,000 to 6,000 stars. Only half are visible at one time, and not all of these from any one location. Astronomers can only estimate the total number. One way they do this is to measure the amount of light and other effects given by a known number of stars and compare this with the effect from the entire sky. One such estimate gives a total of 30 billions. But some astronomers reckon that the Milky Way alone contains 100 billion stars, and the Milky Way consists merely of the stars nearest us. Those stars are gathered into a

cluster called a *galaxy*. Beyond this we can see star clouds called *nebulae*. These are galaxies like the Milky Way. If the high estimate for the Milky Way is near the truth, the total number of stars must be inconceivably large.

Distances to the Stars

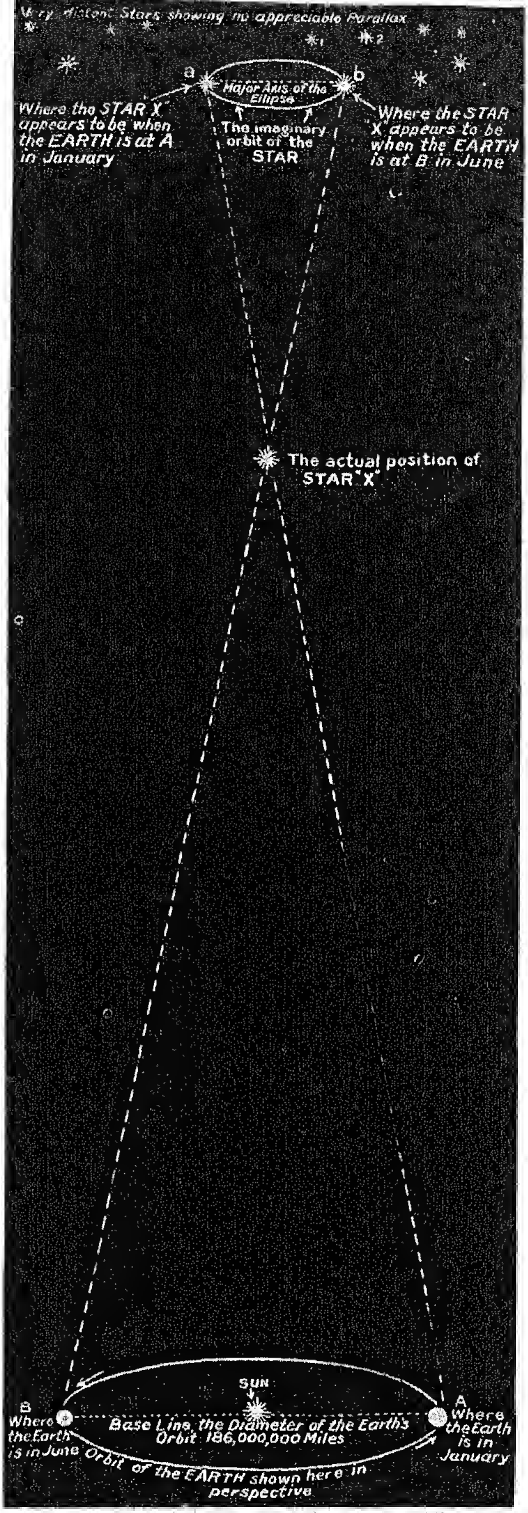
The distances to the stars are so great that it is convenient to measure them in *light-years*, that is, the distance light travels in a year, at the rate of 186,000 miles a second. The nearest visible star to the earth is Alpha Centauri, seen in the southern hemisphere. This is 4⅓ light-years away. In the same constellation is a smaller and perhaps nearer star, Proxima Centauri, which can be seen only with the aid of a telescope. Another recently discovered rival is the dim star Wolf 424. The distance to this star is estimated to be 3.7 light-years. In contrast, some of the nebulae are thought to be more than a million light-years away.

How can such distances be measured? One way is by measuring the *annual parallax* of the star. This process consists in observing the star from one position in the earth's orbit and then six months later from another one, and computing the breadth of the resulting angle. The distances are so great that the angle is very slight, and the measurements must be so delicate that the parallax of only a comparatively few stars has been determined with approximate accuracy. The nearer the star, however, the easier it is to measure this angle, so we know that the many stars which are still unmeasured lie a greater distance than those for which the parallax has been measured. The first parallax determination was made by Bessel in 1838, and is regarded as one of the greatest achievements of science.

Our universe, as astronomers conceive it, is a great sphere so far across that it can only be expressed in figures that stagger the imagination, without conveying any true impression of its immensity. In the central portion of this sphere lies the Milky Way, or Galaxy, a great concourse of stars and nebulae which has been compared to a huge grindstone, with various rifts and breaks (*see* Nebulae). Most of the stars cluster in and about this huge ring or band, growing thinner toward the Poles. The Earth and solar system seem to occupy a position somewhere near the center of the grindstone, yet the movement of the stars is such that some day we may be carried to the outer edge.

If we look at the stars at a particular time at night, and then view them an hour or so later, we see that they have changed their apparent positions in the heavens—that is, with the single exception of the Pole Star. But this change is due solely to the rotation of the Earth on its axis. From a railroad train it often seems as if the telegraph poles were in motion, and the man who observes the stars gets a similar impression regarding heavenly objects. Even the ancients realized that at any particular hour on any particular night of the year—at 12 o'clock midnight on January 1, for example—the stars always present the same picture, and for that

MEASURING DISTANCES TO STARS

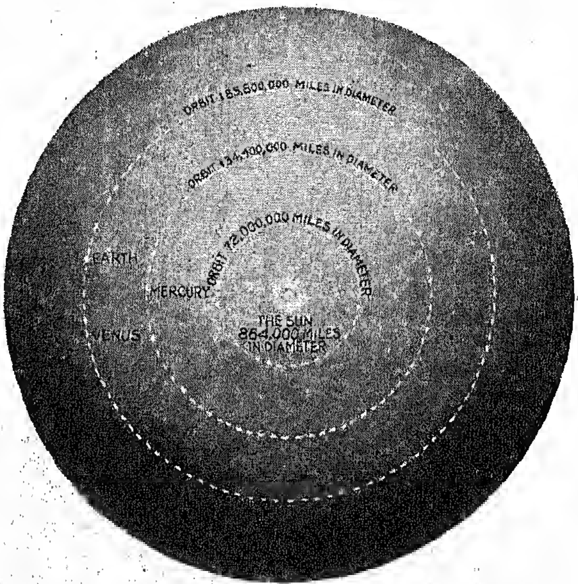


Suppose that an astronomer wants to learn the distance to star "X." From position "A" of the earth he measures the angle between "X" and several exceedingly distant stars, such as "1" and "2." When the earth is at "B," he repeats the measurements. From his knowledge that the changes he detects in the angles are caused by a displacement of 186,000,000 miles in the earth's position, he computes the distance to "X."

reason they called them "fixed stars" as opposed to the planets, which they named the "wanderers."

But the stars are not really fixed, any more than the Earth and the Sun and the Moon are fixed. They are moving among themselves with enormous velocity, and so far as we now know, almost in straight lines. Our Sun, which is itself a star, is taking the solar system along in the general direction of the bright star Vega at a rate estimated as fully 700 miles a minute. At that rate, it will take our system a little over 400,000 years to arrive at the point where Vega now is, if our motion remains unchanged. Some of the other stars move so fast that it seems certain that they will some day escape from our universe altogether, going out into space or nothingness, or perhaps toward other universes of which we have not the faintest inkling or conception. These "runaway stars," as they are called, have in some cases a velocity as high as 200 miles a second; and one of these "speed demons" of the sky could go completely around the earth in a little more than two minutes.

A STAR THAT MAKES OUR SUN A PIGMY



You have been taught to wonder at the enormous size of the Sun. Now try to imagine a star so large that the Sun would be a speck at its center, while three planets—Mercury, Venus, and the Earth—could revolve around the Sun, and still be inside the body of the star! Such is the gigantic and unbelievable size of Betelguese, the first of the stars to be measured by the method described later in this article. The star, with its diameter of about 250,000,000 miles, is represented in this drawing by the whole shaded circle. Yet we know that there are other stars beside which Betelguese itself would seem small.

Stars are ordinarily classified by "magnitudes," in the order of their brightness. In the "first magnitude" are placed the 20 brightest stars—Sirius, *Canopus, *Alpha Centauri, Vega, Capella, Arcturus, Rigel, Procyon, *Achernar, *Beta Centauri, Betelguese, Altair, *Alpha Crucis, Aldebaran, Pollux, Spica, Antares, Fomalhaut, Deneb, and Regulus. (Those marked with an asterisk (*) cannot be seen in northern latitudes.) In the second group are 50 stars, including the Pole Star and the two Pointers. In the third group we have 160; in the fourth, 500; in the fifth, 1,500; in the sixth, 4,000; and so on until in the magnitudes between the 16th and 17th there are supposed to be more than 50,000,000 stars, none of which, of course, can be seen without the most powerful telescopes. The human eye unaided by a telescope cannot see stars of less than the sixth magnitude.

The stars seem to twinkle because of the effect of the Earth's atmosphere on the light waves.

The natural groups or constellations which the stars seem to form in the sky have been given various fanciful or legendary names—for example: Ursa Major (the Great Bear), Lyra (the Harp), Taurus (the Bull), and Orion (the Warrior) (*see* Constellations). In our system of cataloging it is usual to designate the stars in each constellation by Greek letters in the order of their brilliance. Thus the pointer star nearest Polaris is named, according to this system, Alpha Ursae Majoris (brightest star of the Great Bear).

Let us consider for a moment some of the brightest stars. Most important to navigators and explorers is Polaris (the Pole Star), which, though it appears to us as a somewhat dim star of the second magnitude, is disclosed through great telescopes as a triple sun —really three stars instead of one, but so far away that they cannot be distinguished by the naked eye.

The most brilliant of all the stars is Sirius, the "Dog Star," best observed about the first of March. This great sun, which is more than three times as large as our own, has had an interesting career in the annals of astronomy. The discoverer of Halley's comet was the first to suspect that Sirius was not behaving exactly as he should, but it remained for F. W. Bessel in 1844 to work out the facts, though they could not then be demonstrated for lack of powerful enough instruments. He declared that Sirius had an unseen companion star, about half as large; that the two revolved about the same center of gravity; and that they were approaching the solar system at the rate of about 360 miles a minute. An American, Alvan G. Clark, found this companion star with a new telescope he had constructed, and thus Bessel's computations were verified beyond the shadow of a doubt.

Sirius is comparatively near to us, being the third in distance from the sun. But just to give some idea what "near" in this connection means, let us set down the figures. Sirius is 51,000,000,000,000—51 trillion—miles from our Earth!

It happens that the companion of Sirius does not interfere with the light it sends to the Earth; but in the case of Algol, which also has a companion star, a regular eclipse occurs. Algol means "Demon," and it was so called by the Arabs because it shines with

the brightness of the Pole Star for about two and a half days, when suddenly its light is reduced by two-thirds; then in a few hours it regains its former intensity. This peculiar behavior, it has been discovered, is due to Algol's dark companion which, in circling about, gets between the star and the Earth and shuts off part of the light which we receive from it.

Over 50 eclipsing "variables" of the Algol type are known and it is estimated that one star in every four has a partner or companion star. More than 13,000 such stars have been observed and counted.

Vega is not only interesting because the solar system is traveling towards it, but because in about 12,000 years it will become the north star instead of Polaris. This is due to what is called the "precession of the equinoxes," which causes the true north-and-south axis of the Earth to move about in a circle with respect to the stars, like the upper part of a spinning top.

When Stars Explode

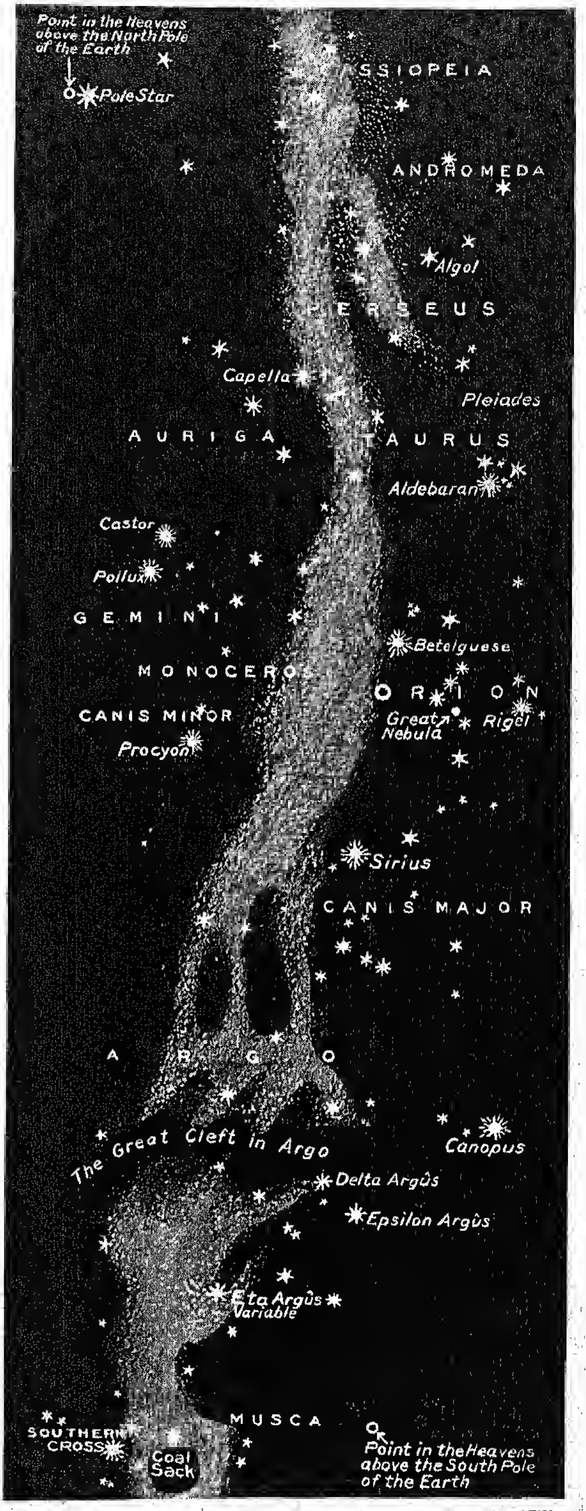
Sometimes stars explode. A star which is ordinarily so dim that it can be seen only with a powerful telescope, if at all, may suddenly flare up and become so bright that it is visible to the naked eye. Some of these *novae* (new stars) flare more than once, but they all eventually decline to their former magnitudes. One of the brightest novae appeared in the summer of 1918 in the constellation Aquila, blazing out as brightly as Sirius, then becoming invisible to the naked eye. Nova Herculis flared up twice between December 1934 and June 1935. The cause of these explosions is not certainly known. Novae are not the same as "shooting stars" (*see* Meteors and Meteorites).

The different colors of the stars—white, blue, yellow, or red—can be made to tell us by means of the spectroscope the chemical elements of which the stars are composed (*see* Spectrum and Spectroscope). Nor is that all; for spectrums differ with temperature, so the spectroscope can tell us how hot a star is. This knowledge, coupled with what we know about the structure of matter and its behavior under different temperatures (*see* Atoms and Electrons), enables us to compute the approximate size of a star, whenever it has a companion, and its age, compared to the Sun.

Thanks to this new knowledge, scientists now believe that stars are either "giants" or "dwarfs." A giant is a young star, just a mass of glowing gas, which is contracting and getting hotter because of the contraction. Sirius and most bright stars are in this class. At a certain point, the heat checks further contraction, and the star remains stable, with a density like water, radiating heat into space, like our Sun. Finally it cools rapidly, giving a reddish light, and dies. The Sirius companion is in this phase, and has contracted to so dense a mass that one cubic inch of it would weigh a ton!

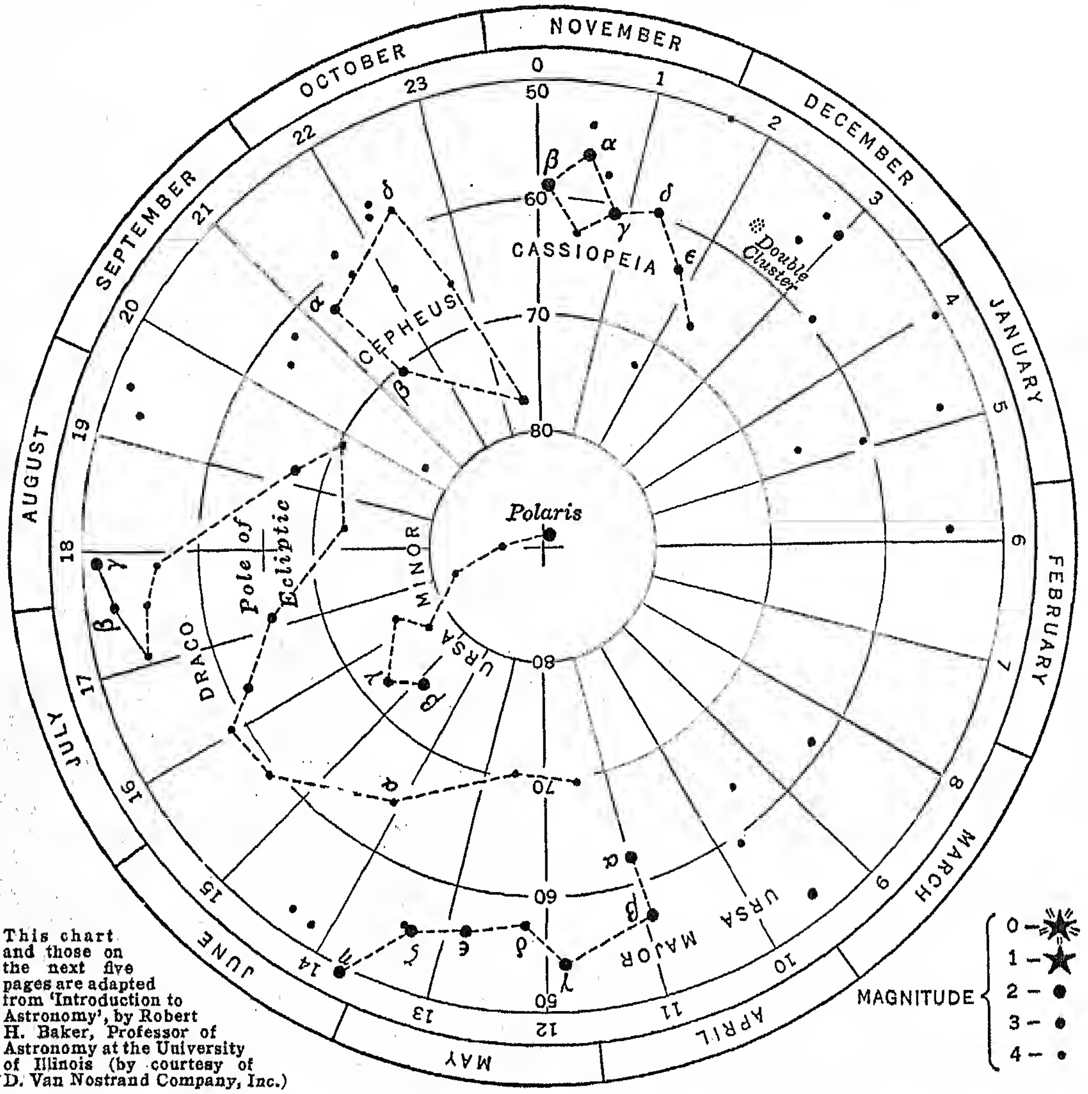
A peculiar class of stars, recently discovered, contains the *Cepheids*—variable stars, formerly supposed to have companions. But the spectroscope indicates

THE "MILK" IN THE MILKY WAY



That long irregular belt of white across the sky, called the Milky Way, or Galaxy, is really made up of myriads of stars which are so far away they look like a misty band. Stars are grouped more thickly in this Milky Way than anywhere else in the heavens.

CHART 1. THE NORTH POLAR CONSTELLATIONS



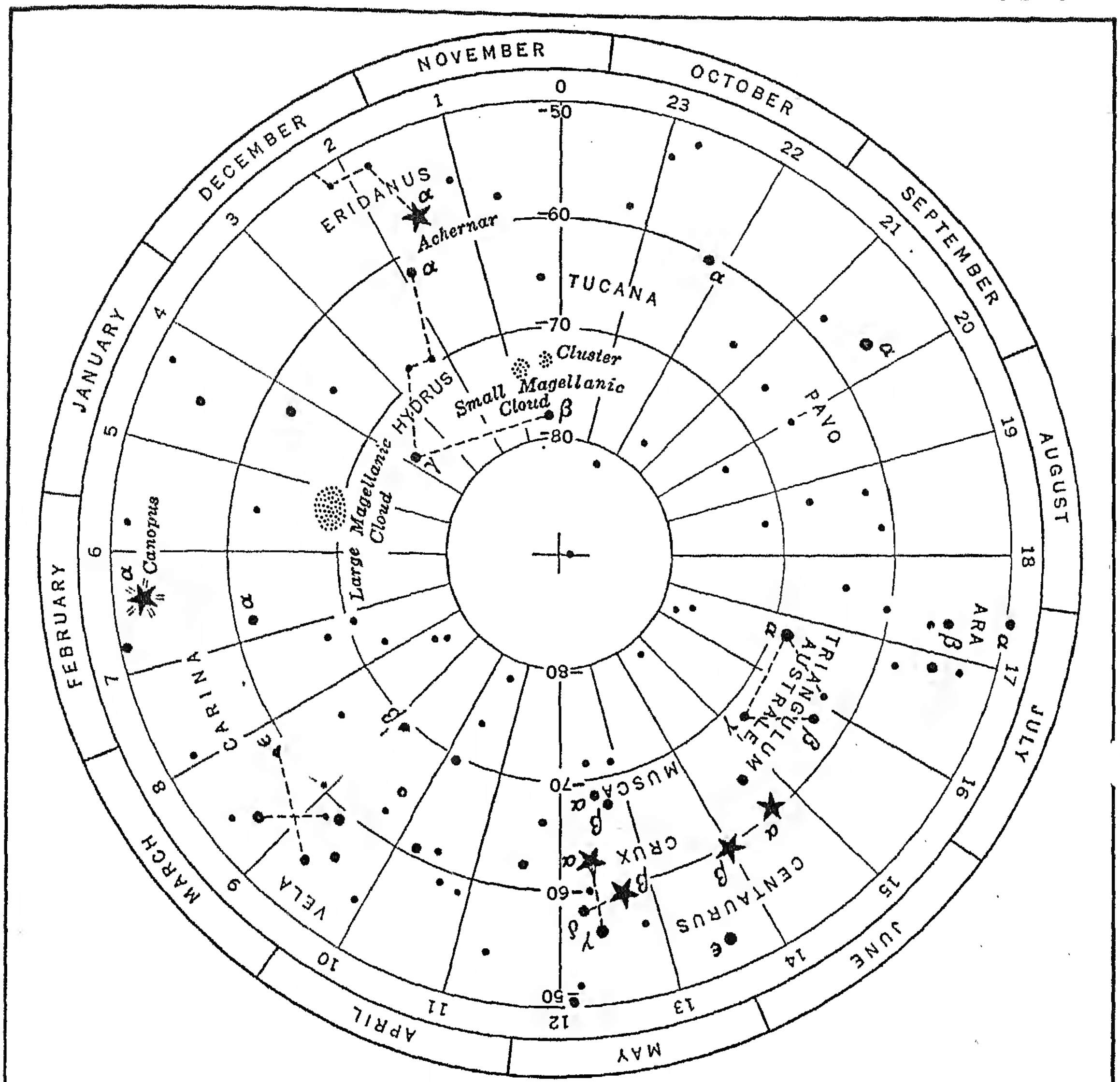
This chart and those on the next five pages are adapted from 'Introduction to Astronomy', by Robert H. Baker, Professor of Astronomy at the University of Illinois (by courtesy of D. Van Nostrand Company, Inc.)

Chart 1 shows the constellations that circle daily in the northern sky without setting, for observers in middle northern latitudes. The north celestial pole is at the center, not far from Polaris, the Pole Star or North Star, at the end of the handle of the Little Dipper (Ursa Minor). The numbers around the edge are hours of right ascension and those on the vertical line are degrees of declination. The names of the months around the outside assist in making the constellations on the chart agree in position with those in the sky. Hold the chart toward the north and turn it until the date is at the top. The chart now shows the constellations as they appear at 9:00 P.M. standard time on that date. For example, at 9:00 P.M. on August 15 the Big Dipper (Ursa Major) is bowl-down in the northwest, while Cassiopeia's Chair is upside down in the northeast. For a later time on that date turn the chart counterclockwise through the number of hours that have elapsed since 9:00 P.M. Thus at 3:00 A.M. on about that date the Big Dipper is right side up under the pole.

Chart 2 shows the constellations that go around the south celestial pole down below the south horizon in middle northern latitudes and never rise into view. These include the celebrated Southern Cross (Crux). When we travel south, the North Pole drops and the South Pole rises toward the horizon. The areas in which stars never set and never rise grow smaller, until at the Equator all stars rise and set. If we continue on to a place somewhat south of Buenos Aires, we shall then use Chart 2 to recognize the constellations that never set and shall find that those of Chart 1 never rise.

Charts 3, 4, 5, and 6 represent the constellations that appear mostly in the southern sky in the early evening at each of the four seasons in middle northern latitudes. The numbers at the bottom are hours of right ascension and those along the vertical line are degrees of declination. With reference to these numbered lines the right ascension and declination of any star can be read from the chart just as the longitude and latitude of a city can be read from a map of the earth. As an example, the right ascension of Regulus in the constellation Leo (Chart 3) is about $10^h\ 5^m$ and its declination is about 12° north. The sun, moon, and planets are not

CHART 2. THE SOUTH POLAR CONSTELLATIONS



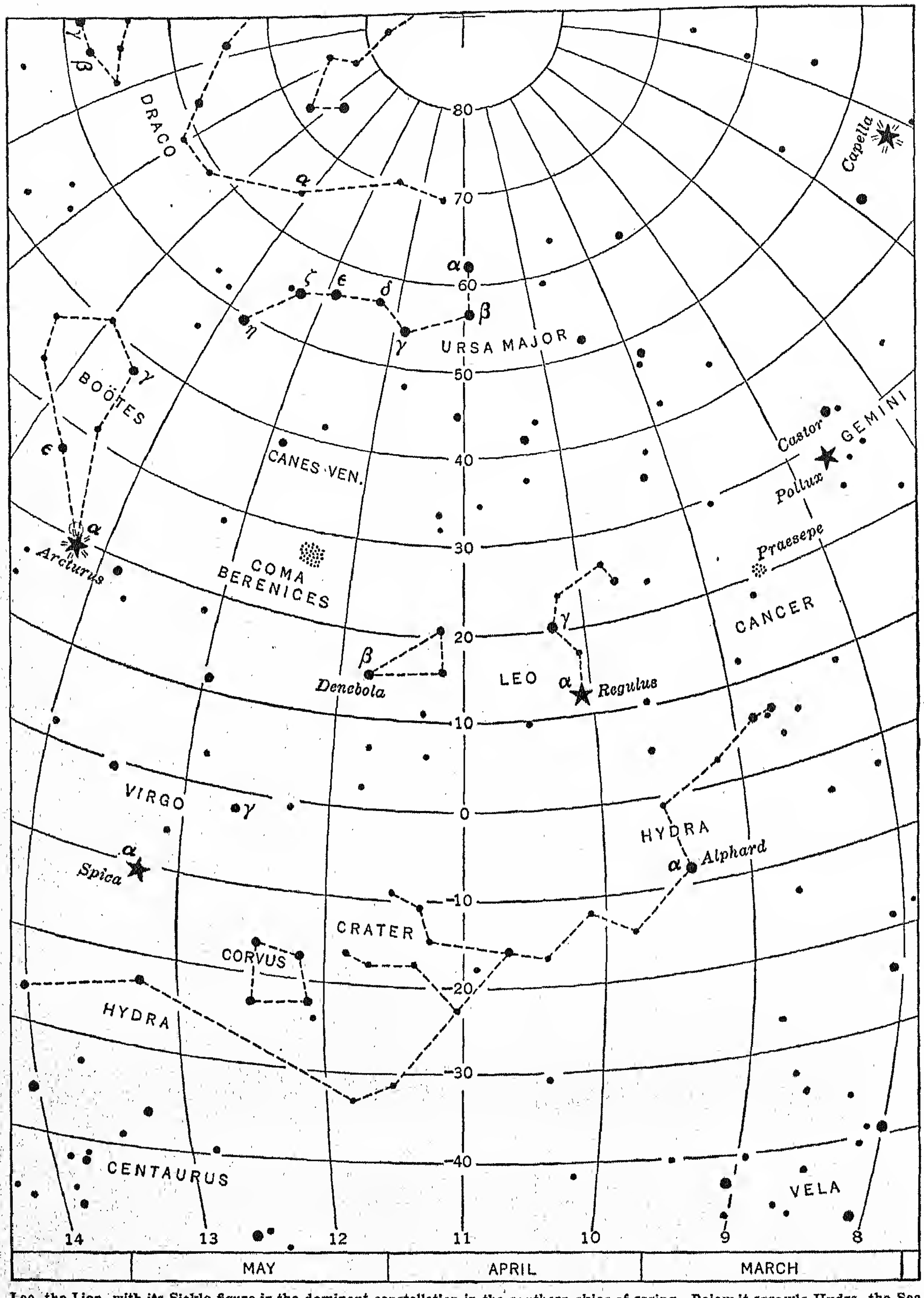
shown on the charts, of course, because these bodies move about among the constellations. Their positions (right ascension and declination) may be found for any date in the American Nautical Almanac.

The four seasonal charts are to be held toward the south. The bottom of each chart represents the south horizon. The declination circle marked 0 is part of the celestial equator. Declination circle 40 passes nearly overhead in about the latitudes of New York and Chicago. The constellations near the tops of the charts are therefore in the northern sky; these are more conveniently arranged in Chart 1. The reason for extending the seasonal charts to the north celestial pole is to show the relations between the southern constellations and the familiar ones in the north. Notice, for example, in Chart 3 that the bright star Arcturus is readily found by following the curve of the Big Dipper's handle.

Broken lines emphasize the prominent geometrical figures formed by the stars, figures such as dippers, squares, and crosses which are familiar to anyone who "knows the constellations." The names associated with these figures, particularly the figures recognized by ancient peoples, are mostly the Latin names of animals and heroes. Ursa Major, the Larger Bear, and Hercules are examples. Some of the 88 constellations that are recognized today contain neither characteristic star figures nor bright stars; these are omitted here in the interest of simplicity. For the same reason the boundary lines between the constellations are not shown on the charts. A constellation is technically an area of the heavens, and a star belongs to a particular constellation if it is within its boundary.

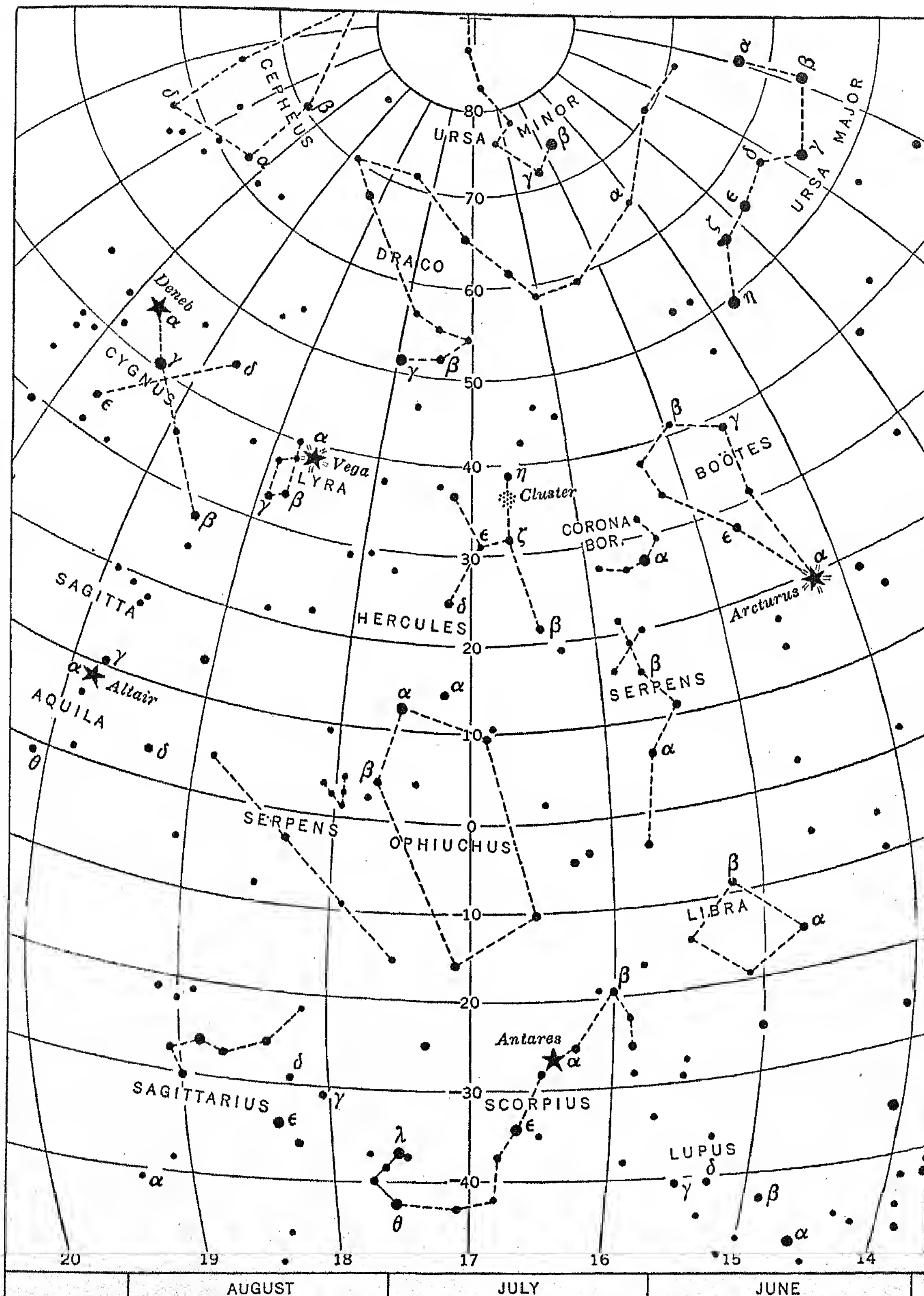
The brighter stars are designated either by special names, such as Arcturus and Regulus, or in another way which is much used in astronomy. The stars in a constellation are known by small letters of the Greek alphabet followed by the possessive of the Latin name of the constellation, and the lettering is roughly in order of brightness in the constellation. Thus the brightest star of Taurus (Aldebaran) is α Tauri and the second brightest star in Ursa Minor is β Ursae Minoris. This is why the Greek letters appear on the charts.

CHART 3. STARS OF THE SPRING



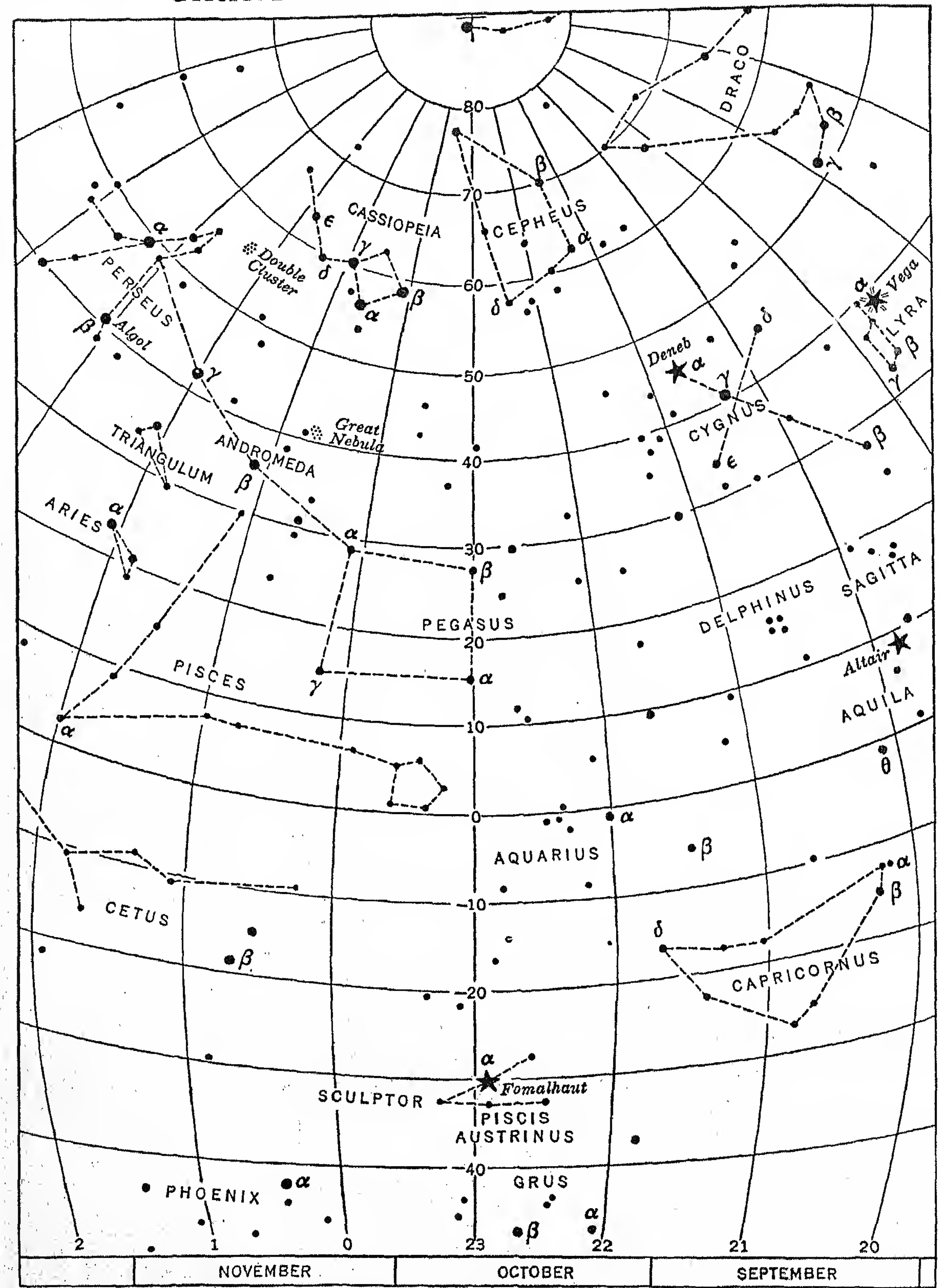
Leo, the Lion, with its Sickle figure is the dominant constellation in the southern skies of spring. Below it sprawls Hydra, the Sea Serpent. Two star clusters, Praesepe and Coma Berenices, invite the stargazer to bring out his binoculars.

CHART 4. STARS OF THE SUMMER



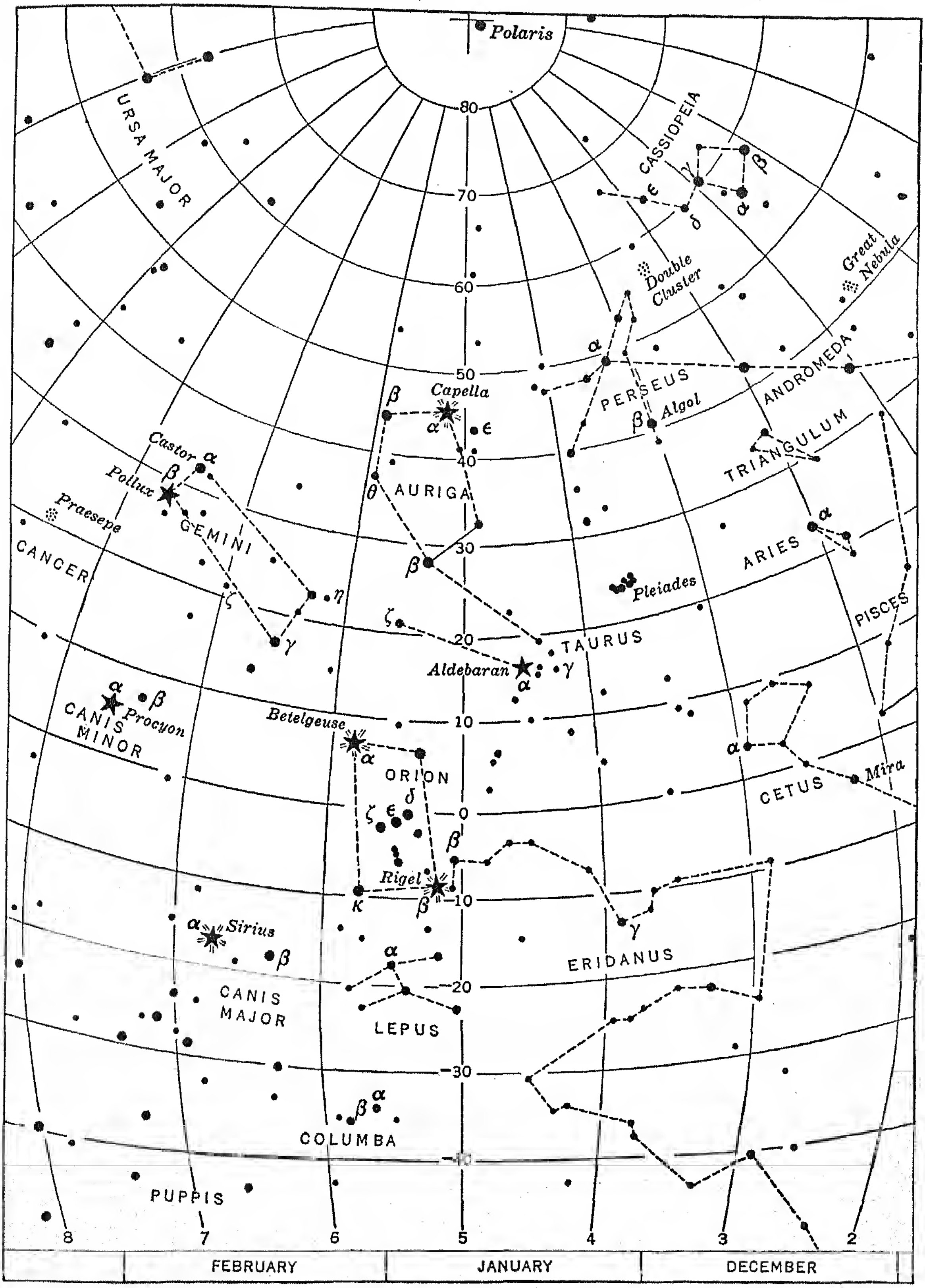
When you gaze at the fine array of constellations in the summer skies notice the contrast between blue Vega and red Antares. Cygnus, the Swan, is better known as the Northern Cross. The brightest part of the Milky Way extends southward from here to Scorpius.

CHART 5. STARS OF THE AUTUMN



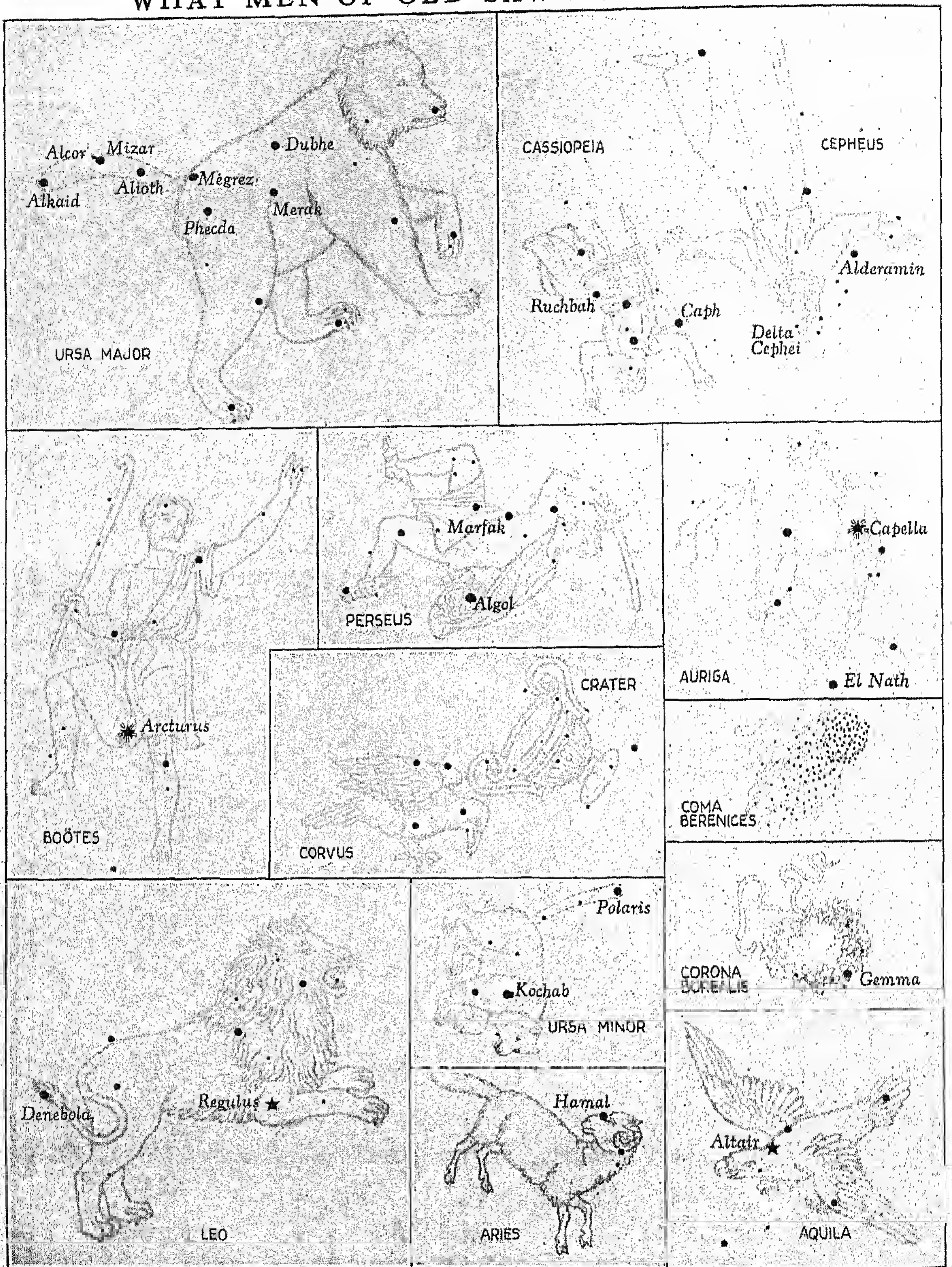
The great square of Pegasus appears in the southern skies of autumn. Imagine that this is the bowl of a dipper and look to the north-east for the handle. The handle is formed by bright stars of Andromeda and Perseus. Most of the other figures are dim.

CHART 6. STARS OF THE WINTER



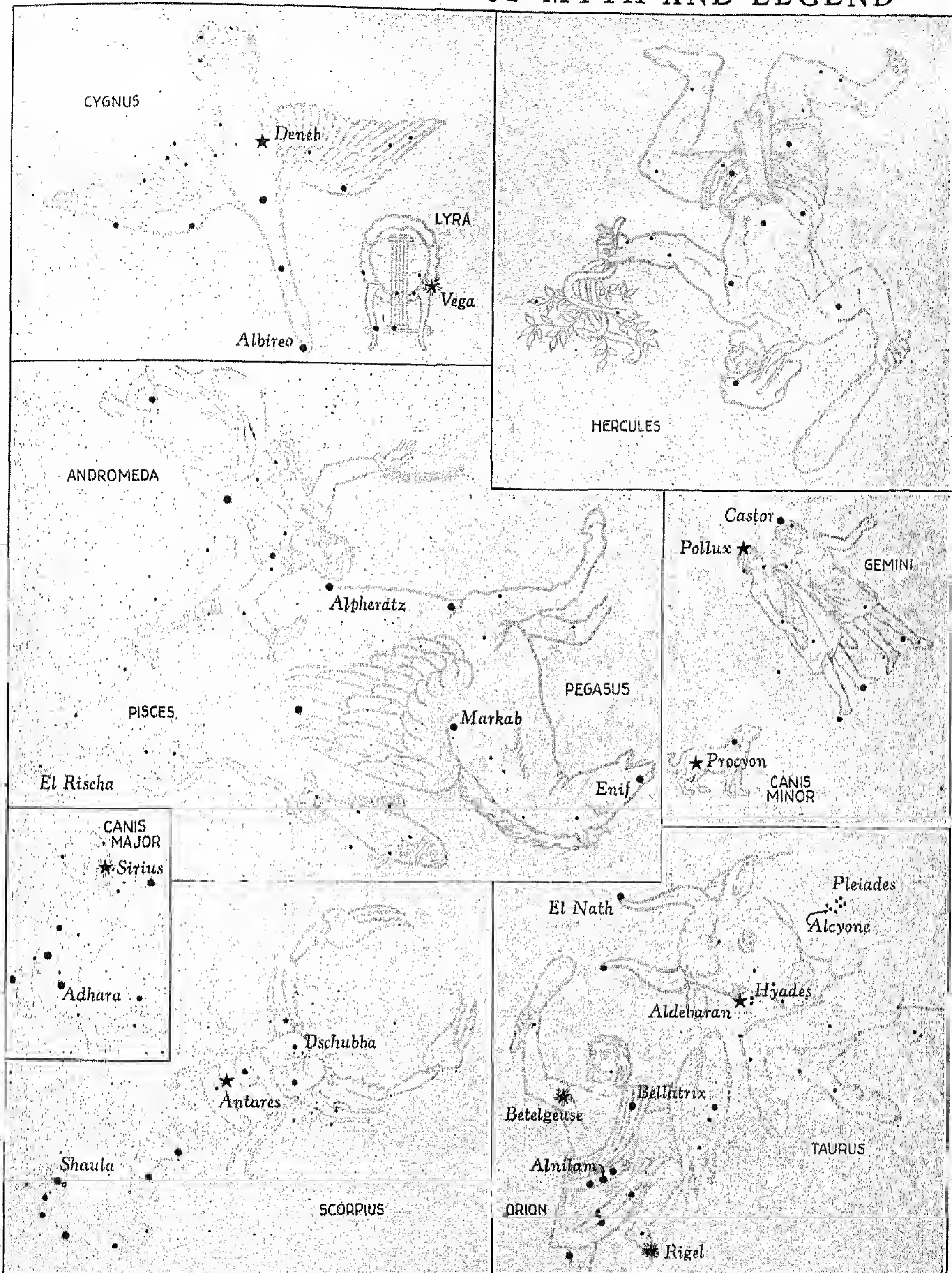
Winter brings the brightest constellations into the evening sky. Orion, with its brilliant Betelgeuse and Rigel, is the brightest of all. The line of the three stars of Orion's belt directs the eye to Sirius, the Dog Star, and to the Pleiades.

WHAT MEN OF OLD SAW IN THE SKIES



On this page and the next are shown the principal mythological figures which the ancients associated with various constellations. The orientation of each constellation is the same as in the star charts on the preceding pages, and its position in the heavens can be easily determined with the aid of those charts. For example, Leo is shown here in the same position it occupies on page S-275c. The star names have come down to us from ancient times. From the maze of stars that dot the night sky, the shepherds, sailors, and desert nomads of old picked out the brightest groups, the constellations, and wove stories about them.

STRANGE CREATURES OF MYTH AND LEGEND



In the eyes of the ancients these star groups took on the shapes of gods and goddesses, of heroes and heroines, of beasts and birds. It requires a lively imagination to read this picture book of the sky as the ancients conceived it, but literature is rich in the legends of the celestial menagerie. There is the story, for instance, of Orion the mighty hunter who was stung to death by Scorpius for his boast that no animal on earth could conquer him; also the story of Berenice, the beautiful Egyptian queen whose shorn tresses were placed by Jupiter in the sky for safekeeping.

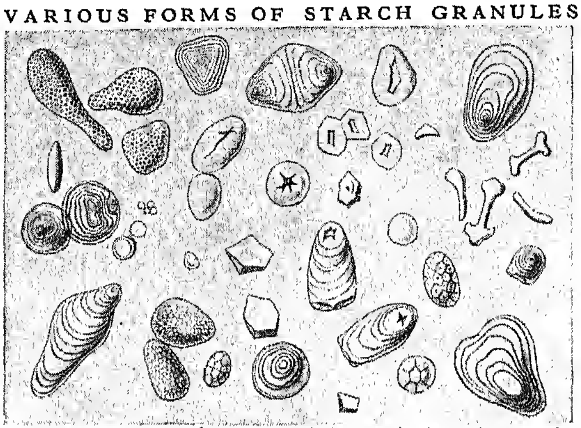
that they expand and contract. Imagine a toy balloon expanding several million miles every few weeks, then contracting, and you will see what peculiar stars these must be!

One of the greatest recent achievements of astronomy has been the invention of a method for determining the diameter of stars, by Professor Michelson of Chicago. The stars are so far away that they appear as points in the telescope, no matter whether large or small, and so cannot be measured by any previously known method. Professor Michelson found, however, that if a plate containing two parallel slits be placed over the objective of the telescope, the image of a star viewed through the slits would be crossed by bars of light and darkness, because of "interference" (*see* Light). Then as the slits are moved apart, the bars disappear. The amount of separation required to cause this disappearance depends upon the distance and diameter of the star. Using this method, members of the Mt. Wilson observatory staff found the diameter of Betelguese, the brightest star in the constellation Orion, to be about 250,000,000 miles—great enough so that if its center were placed at the center of the Sun, its outer edge would lie just inside the orbit of Mars, thus engulfing nearly half of the whole solar system!

When one thinks of how long men have studied the stars, and yet how great are the marvels revealed in the past hundred years, there seems almost no limit to the hopes we may have of yet further knowledge of these mysterious, far-off, awe-inspiring worlds of the heavenly firmament.

STARCH. Stored up in most plants, especially in the seeds, bulbs, tubers, etc., is a substance called starch ($C_6H_{10}O_5$), which is one of the most important elements of plant life. It has the same elements as sugar—carbon, hydrogen, and oxygen—but in different proportions. It occurs as small grains or granules, which differ in shape in each species of plant. Starch is found especially in cereals, potatoes, carrots, parsnips, sago, tapioca, and rice. Potatoes are about one-fifth starch, not all recoverable; rye, wheat, and corn, almost three-fourths; oats, about two-thirds; rice, about four-fifths. Some 80 per cent of the starch of commerce comes from corn; cassava (tapioca) is next in importance. The corn is soaked in water for 48 hours, then ground and strained through sieves, after which the starch is allowed to settle in vats, when it is washed, bleached, and dried. Potato starch is made by grating potatoes, adding water, and straining, settling, washing, and drying. Wheat starch and rice starch are made by slightly different processes, to remove the gluten they contain.

VARIOUS FORMS OF STARCH GRANULES



All green plants manufacture starch, but each plant differs in its ideas of what its granules should look like and what size they should be. Under the microscope they are seen to consist of a nucleus surrounded by layers. In several of the granules in this group the layers may be plainly seen.

As usually prepared, starch is either a white powder or irregular white lumps, which come from the breaking up of a dried cake of the material. It does not dissolve but is merely suspended in cold water, but in hot water the granules burst, forming a clear paste, which is the starch used in the laundry. When heated to about 360° Fahrenheit, it is changed into dextrine, the gum used on postage stamps.

Cornstarch was first made in the United States in 1842, the factory at Oswego, N. Y., early becoming famous as one of the largest starch factories in the world. Argo, Ill., a suburb of Chicago, now leads the world in this important manufacture.

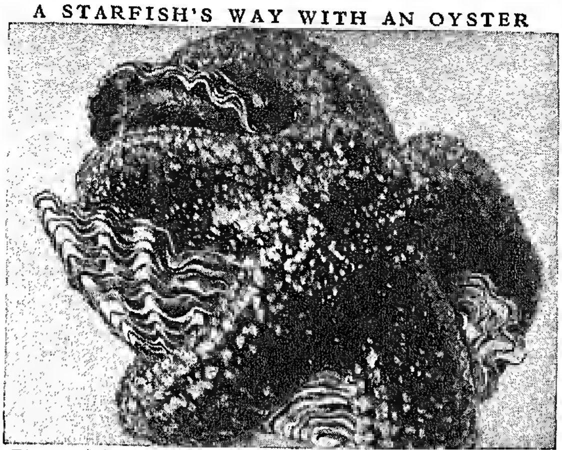
STAR CHAMBER. This term was first applied to an English court which met in the council chamber of the palace at Westminster. The roof of the room was decorated with gilt stars, which are supposed to have given the court its name. The court was founded or restored in 1487 by Henry VII, to assist in bringing to justice the great land-owners and nobles. It was independent of a jury, who were too often afraid of the nobility, and it could inflict any punishment but death. The trial was conducted by written questions, unless the accused chose to confess. Torture came to be used to extort confessions, and in the reign of Charles I such an outcry was raised against the abuse of its power that the court was abolished in 1641.

STARFISH AND SEA-URCHINS. The "sea-star" that one sees through shallow water near an ocean beach, lying flat on the sand or clinging to some barnacle-dotted rock, is a queer creature. One or another sort is to be found in all parts of the world except the polar regions; and the common one of the North Atlantic is altogether too common on the oyster-beds, for it crawls there in thousands, and destroys perhaps $100,000 worth of oysters every year in Long Island Sound alone.

A well grown starfish has the shape of a regular five-pointed star, about six inches across and an inch thick in the center. It is brown in color and covered with a mosaic of limy plates and rows of points, and near the center is a small sievelike opening. This is its dorsal (back) surface. Turn it over. The lower or ventral side shows a "furrow," broadening from

the tip of each of the five "arms" toward the center, where a circular opening (the mouth) is closed at the moment by five pointed teeth meeting at the center. That mouth opens into a loose bag of a stomach, whose folds extend out into the arms; and around it is a circular system of water-tubes, blood-vessels, egg-producing organs, and so forth.

A STARFISH'S WAY WITH AN OYSTER



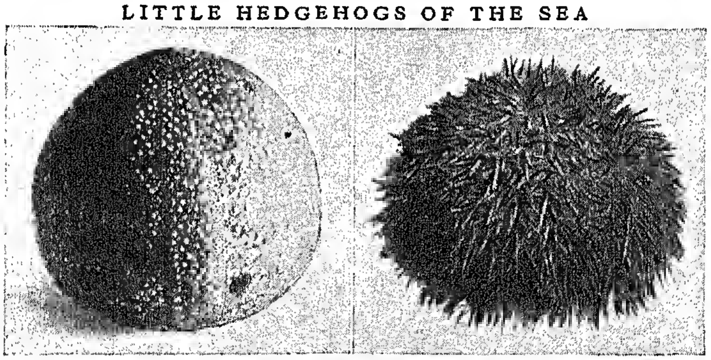
The starfish attaches itself to the shell and pulls. The oyster resists until worn out, then yields and is eaten.

Now put your starfish (which is not a fish at all) into an aquarium. When he crawls up its glass wall, showing his under side, you see, pushed out from rows of tiny holes in the furrow, slender glassy tubes ending in a sucker by which the animal clings to the glass. They are swollen with water sucked in through the sieve in his back, and it is by these clinging "feet" that the starfish pulls himself slowly over the sea-floor.

Starfish are of many kinds and varied shapes. Some are very thick, with short fat arms; others are small and flat, with snaky arms (brittle stars); others have the arms many-branched (basket-fish), and so on. If a starfish loses an "arm" it promptly grows another; and if it is cut into halves, each piece grows into a new individual.

Starfish are one of the three divisions of a class of marine animals called *Echinoderms*, that is, "spiny-skinned" animals. All have their internal organs—and to some extent their outer form—arranged in five parts around a central stomach. The other two divisions are the sea-urchins and the sea-cucumbers. The latter are highly prized as food in the Orient, being known as "trepang" (*see* Sea-Cucumber).

LITTLE HEDGEHOGS OF THE SEA



Why a creature that looks like this should be called an "urchin" seems odd until we know that "urchin" in this connection is a contraction from "hérisson," a French word meaning "hedgehog." That is plain enough, isn't it? On the left you see the Sea-urchin with his prickly overcoat removed.

The sea-urchins are as various in shape as the starfish. Some, like the sand-dollars, are as flat as a thin cookie, and when you rub off the velvet-like skin you find on the lower side a five-pointed pattern of holes for tube-feet, precisely as in a starfish. Another kind has the shape and bigness of a bun; and here, again, under the spiny coat of its flat lower side, you can see the five furrows. In the spherical or egg-shaped sea-urchins, these furrows extend up the sides, and the tube-feet are longer than in starfishes. By means of these and its spines, the animal can move along at about as slow a rate of travel as one can imagine. But these are not restless folk, and most of them sit calmly where they find themselves, hoping to be overlooked in their dull green or purplish coat by the big fishes, turtles, and other enemies who consider their soft insides good eating. Their bristling spines which protect them against small fishes, crabs, worms, etc., make small sea-urchins resemble a chestnut-bur; while the large ones are really formidable to anything less than a ground-shark. In among the spines, which are mounted on a sort of hinge and may be waved about, are scattered many queer flexible appendages ending in a sort of finger and thumb. With these the urchin (which is derived from the French word for "hedgehog") picks off and throws away particles of drift and dirt that get entangled in his rough overcoat. All sit or move about face down and get their living by scooping up mud, out of which the stomach extracts nourishment from the minute life it contains, or by nibbling edible things which adhere to rocks and weeds.

Starfishes and sea-urchins mature every summer great numbers of minute eggs that are poured out into the water. Most of these eggs soon disappear down the throats of sea-anemones and other hungry creatures. But from a few are hatched strange little young (*larvae*) that drift about until (in most cases) they are eaten by some creature. Now and then one escapes and settles down in some safe spot on the bottom, where it is left to grow into an adult of its kind.

STARLING. The starling is a bird foreigner whose value as an American citizen birdlovers seriously question. When this singing blackbird was introduced from England into New Zealand, it became a very destructive pest. Since their importation into the United States in 1890, when 60 specimens were liberated in Central Park, New York, the increase

and spread have been rapid. Besides their tendency to destroy fruit, their pugnacious disposition leads them to drive out other songbirds, as well as sparrows and flickers. They have even been known to conquer a male sparrow hawk.

The starling is about eight inches long, and has beautiful black plumage, brightly shot with purple, green, and steel blue; most of the feathers are tipped with buff. (For illustration in colors, *see* Birds.)

In Europe, especially in Great Britain, the starling *Sturnus vulgaris* is a great favorite. It is very active and interesting, with a most sociable disposition, nesting among buildings and becoming quite tame. Out of fruit season, when its food is largely insects, farmers consider it a valuable addition to their bird population, but a large flock of hungry starlings is not welcome in field or orchard.

STATE GOVERNMENTS. While the men of 1776 were writing their Declaration of Independence from England, they had also to turn their attention to forming governments for the separate colonies, or "states" as they were called after the Declaration was issued. This political division, next below the Federal government in size and importance, thus goes back to the very beginning of American national history; and rival schools of historians have disputed whether the states preceded the Union or the Union the states. At first there were only 13 such commonwealths. Today there are 48, for 35 have been admitted by Congress; but all, both old and new, are alike in the main features of their governments.

In the first place the United States Constitution puts certain limits upon all. It guarantees to the citizens of all the states a republican form of government. Each must extend the same privileges to citizens of other states that it gives to its own. It must also return fugitives from justice who are charged with treason, felony, or other crime; this is called "extradition." Likewise the state cannot exercise any power which is conferred upon the national government alone, such as levying import duties, coining money, etc.

The Constitutions of the States

Every state has a written constitution, for Congress will not admit a new state to the Union until it has formed an acceptable constitution. Some of these documents are long, some comparatively short, but all contain certain features. In practically every one there is a Bill of Rights listing rights which the state may not take away from the individual. In all there are provisions for the organization of the legislative, executive, and judicial departments, and defining the powers and duties of each. And finally there are provisions for amendments and revision, for state constitutions are frequently changed, the average life being from 20 to 30 years.

In 23 states the legislative body is known as the "Legislature," in 20 as the "General Assembly," in 3 as the "Legislative Assembly," and in New Hampshire and Massachusetts as the "General Court." Nebraska has only one house in the legislature; every other state has two, although Pennsylvania, Georgia, and Vermont at one time had legislatures composed of only one house. Membership in the upper house varies from 17 in Nevada to 67 in Minnesota; that of the lower house from 35 in Delaware to 423 in New Hampshire.

The legislatures of five states meet every year, that of Alabama meets only every four years, and those of the others every two years. At these meetings the legislatures may pass upon any subjects "not delegated to the United States by the Constitution, nor prohibited by it to the states." For example, they can legislate concerning taxation, inheritances, mortgages, corporations, marriage and divorce, crime, public health, education, and business or professional regulations. From this list of subjects you can see that the state is the most important division of government so far as the individual is concerned.

Duties of the Governor

To carry out these laws each state has a governor elected by the people. His term is either two or four years in all the states except New Jersey, where he is elected for three years. All of the states except North Carolina give the governor the right to veto laws passed by the legislature, but in some states this is only a "suspensive veto," and can be overridden by a mere majority vote. He may also call extra sessions, recommend laws to be passed, and pardon criminals. He is charged with the duty of enforcing the laws of the commonwealth, but as the officers through whom he executes this duty are in large part elected by the people and are not responsible to him, this provision amounts to little except in cases of extraordinary emergency.

Each state also has a system of courts to try those who are accused of violating its laws (*see* Courts of Justice). There are always a number of other officials, such as the superintendent of public instruction, the board of medical examiners, auditor, state treasurer, attorney-general, etc.

The word "state" is also used in a more general sense to indicate any sovereign government; thus Great Britain, France, Germany, Russia, are "states" in this wider sense. The term "country" is purely geographic, and may be applied to a district that has no separate government.

The term "nation" refers to the *people* primarily, and not specially to the government. But not every "people" constitutes a "nation"; the essence of nationality is the desire and will on the part of a people to constitute a state—common memories of the past, common interests in the present, common hopes for the future. Possession of the same blood, language, and religion and residence in a well defined geographical unit or country are principal factors in producing a sentiment of nationality; but none of these is indispensable. Thus the Swiss, in spite of the fact that different cantons speak German, French, and Italian, that some are Catholic and others Prot-

HOW THE STATES GOT THEIR NAMES—THEIR NICKNAMES AND SYMBOLS

NAME	PROBABLE ORIGIN AND MEANING	POPULAR NAME	FLOWER OR SYMBOL
Alabama	From Creek Indian word meaning "place of rest," or from name of Alibamu Indians	Cotton State	Goldenrod
Arizona	Indian word meaning "place of small springs"	Apache State	Sahuara cactus
Arkansas	Name of Indian tribe, meaning "down-stream people."	Wonder State	Apple blossom
California	From name of a fabled island in Spanish romance, or from *caliente forno* ("hot furnace"), first applied to Lower California	Golden State	Golden poppy
Colorado	Spanish word meaning "reddish colored," first given to the river	Centennial State	Blue columbine
Connecticut	From Connecticut River, originally called by the Indians "Quonoktacut"	Nutmeg State	Mountain laurel
Delaware	From Lord de la Warr, first governor of Virginia	Blue Hen State	Peach blossom
Florida	From *Pascua florida*, Spanish for "Easter Sunday" (Flowery Feast)	Everglade State	Orange blossom
Georgia	In honor of King George II of England	Cracker State or Empire State of the South	Cherokee rose
Idaho	Indian word meaning "gem of the mountains"	Gem State	Syringa
Illinois	Indian tribe, Illini ("men"), with French ending	Prairie or Sucker State	Violet
Indiana	Formed by adding "a" to "Indian" ("land of Indians")	Hoosier State	Zinnia
Iowa	Indian name of uncertain meaning; perhaps "this is the place"	Hawkeye State	Wild Rose
Kansas	From Indian tribe, kanzas, meaning "wind people"	Jayhawker or Sunflower State	Sunflower
Kentucky	Probably from "Kentake," Indian name meaning "meadow land" or "prairie"	Blue Grass State	Goldenrod
Louisiana	"Land of Louis," in honor of King Louis XIV of France	Pelican State	Magnolia
Maine	Perhaps from name of province in France; styled "Province of Maine" in charter of 1622	Pine Tree State	Pine cone and tassel
Maryland	In honor of Queen Henrietta Maria of England	Old Line State	Black-eyed Susan
Massachusetts	Name of tribe of Indians, originally given to bay, meaning "place of great hills"	Old Bay State	Mayflower
Michigan	From Indian word meaning "great lake" or "great water"	Wolverine State	Apple blossom
Minnesota	Indian name meaning "clouded water"	Gopher State	Moccasin
Mississippi	From Indian word meaning "gathering of all the waters" or "great river"	Bayou State	Magnolia
Missouri	Indian word meaning "big muddy stream"	Bullion State	Hawthorn
Montana	Latin for "mountainous region"	Treasure State	Bitter root
Nebraska	Sioux Indian name meaning "shallow water"	Tree-Planter State	Goldenrod
Nevada	Spanish for "snowy"	Sagebrush or Silver State	Sagebrush
New Hampshire	From the county of "Hants" or "Hampshire" in England	Granite State	Purple lilac
New Jersey	From island of Jersey in the English Channel	Garden State	Violet
New Mexico	From Indian name Mexitl, an Aztec divinity	Sunshine State	Yucca
New York	In honor of the Duke of York, afterward James II of England	Empire State	Rose
North Carolina	"Land of Charles," in honor of Charles II of England	Old North State or Tar Heel State	Dogwood
North Dakota	Indian name of confederate Sioux tribes, meaning "allies"	Flickertail State	Wild prairie rose
Ohio	Indian name meaning "beautiful river"	Buckeye State	Scarlet carnation
Oklahoma	Choctaw Indian name meaning "red people"	Sooner State	Mistletoe
Oregon	From name at first given to Columbia River and popularized in Bryant's 'Thanatopsis'	Beaver State	Oregon grape
Pennsylvania	Latin form for "Penn's woods" in honor of its founder, William Penn	Keystone State	Mountain laurel
Rhode Island	From Dutch *Roode Eylandt*, meaning "red island"	Little Rhody	Violet
South Carolina	*See* North Carolina	Palmetto State	Yellow jessamine
South Dakota	*See* North Dakota	Sunshine State	Pasque flower
Tennessee	Indian name for Tennessee River; meaning unknown	Volunteer State	Iris
Texas	Named from Texas tribe of Indians	Lone Star State	Bluebonnet
Utah	From *Ute*, Indian name meaning "high up"	Bee-Hive State	Sego lily
Vermont	French name meaning "green mountains"	Green Mountain State	Red clover
Virginia	From the "Virgin Queen" Elizabeth of England	The Old Dominion	Amer. dogwood
Washington	In honor of George Washington	Evergreen State	Rhododendron
West Virginia	*See* Virginia	The Panhandle State	Rhododendron
Wisconsin	Indian name of uncertain meaning; perhaps "wild rushing river" or "meeting place of the rivers"	Badger State	Violet
Wyoming	From Wyoming valley in Pennsylvania (scene of Indian massacre in 1778)	Equality State	Indian paint-brush

estant, and that there is considerable difference of blood (race), undoubtedly now constitute a nation. On the other hand, it was doubtful until after the Civil War whether the United States was or was not a nation.

STATES' RIGHTS. When the 13 American colonies in 1776 separated themselves from England, according to one view each one stood as an independent nation, though they knew that they must ultimately be united. If they stayed divided they would be reconquered by England or taken by some other nation. Accordingly in the Articles of Confederation (1777) they formed a Federal government to which each state gave some of its rights. But they gave so few that the government under the Articles proved too weak to accomplish anything, and so in 1787 a new Constitution and Federal government were formed to meet the problem.

Under this new Constitution, each state now gave up many more of its rights to the central government. But still many people claimed that the people of a state owed their first duty to that state; that if a state law conflicted with a Federal law, the state law should be obeyed; and finally, that if a state did not approve of a Federal law it might declare that the law should not be enforced in the state—in other words, might "nullify" it. This idea was known as the "Doctrine of Nullification and States' Rights," and its aim was to prevent the federal government from acquiring sovereign power.

The first appearance of this doctrine was in 1798, when the legislatures of Kentucky and Virginia protested against the Alien and Sedition laws (passed by the Federalists), which permitted the president of the United States to remove from the country aliens or foreigners whose presence was considered dangerous, and to punish anyone who by speech or writing stirred up sedition or rebellion in the United States. During the War of 1812, Federalist New England, which was opposed to the conflict, refused to obey President Madison's call for troops and even threatened to withdraw from the Union.

Later the idea became part of the creed of the Southern states and of their leaders. Their "peculiar institution" (slavery) was constantly threatened by Federal legislation, and their lack of manufactures made them equally hostile to tariffs and other Federal legislation urged by the more industrial North, with its free labor. "States' Rights" was the South's first line of defence against this increasing tendency to national government.

In South Carolina, in 1832, it was declared that the high tariff law was "null and void" and that its citizens need not obey it. President Jackson's firm attitude—as announced in his toast "The Federal Government, it must be preserved"—and the passage of a more moderate tariff law settled the trouble for that time. It was then that Webster in his orations gave classic form to the idea of "the Union, one and inseparable."

In 1860–61 the Southern states attempted to carry out their oft-repeated threat of secession. They claimed that, as they had voluntarily joined the Union, so they could leave it at pleasure. The North, on the other hand, claimed that no state had a right to leave the Union of its own will. The Civil War followed, and the North by force of arms compelled the South to accept their belief.

Since the Civil War no one has thought that a state could secede from the Union or nullify a national law. "States' Rights" in that sense is dead. But some still hold that as many rights as possible should be left to the states, and that in case of doubt as to whether a right has been granted to the Federal government or retained by the states, it should be given to the state. This belief is steadily losing ground today, and the central government is using more and more of the rights formerly exercised by states.

The MACHINE *that Puts* STEAM TO WORK

The Story of the Steam Engine from Hero of Alexandria to James Watt and Our Own Day—How a Lazy but Ingenious Lad Helped Develop It—What "Horse-Power" Means

STEAM ENGINE. The steam engine is a device for converting the heat energy of steam into mechanical work, and thus belongs to the class of devices called heat engines. Other forms of heat engine are the gas engine and the hot air engine, devices for turning the heat of exploding gas mixtures, or of expanding hot air, into mechanical work. The first attempted use of steam to do work dates back to the 2d century B.C., when Hero of Alexandria devised several forms of steam apparatus—apparently only toys, if indeed, they were really built.

The beginning of the modern steam engine was in the water-raising engine of Thomas Savery in 1698. In this the steam acted directly on the water to be raised. The first use of the piston was by Papin in 1705 in a modification of Savery's engine. In the same year Thomas Newcomen made a piston engine which more nearly approached our modern form. It was, as its name implied, an atmospheric engine. The piston working in a cylinder was connected by a chain with one end of an overhead beam. Steam admitted from the boiler to the cylinder allowed the piston to be raised by a heavy counterpoise hung from the other end of the beam. Then the valve was shut and the steam in the cylinder condensed by a jet of cold water. This left a vacuum in the cylinder and the piston was forced down by the pressure of the atmosphere, and work was done by lifting a pump-rod which was fastened to the other end of the beam. The common story is that a lazy ingenious boy named Humphrey Potter, who had been set to turn the valve, made the engine close and open its own valves by means of cords and thus invented the first automatic valve-gear.

Newcomen's engines were used solely for pumping water from the English coal mines. The modern steam engine is due to James Watt (*see* Watt, James), an instrument-maker for the University of Glasgow. Watt condensed the steam in a separate vessel called the condenser, instead of chilling the cylinder with a water jet, and surrounded the cylinder with a steam jacket. A pump maintained vacuum in the condenser. These inventions saved steam and cut down fuel costs. Watt's later engines were double-acting, with steam and vacuum applied alternately to each side of the piston, thus increasing the steadiness and amount of power furnished. A final fundamental improvement was using steam expansively—in other words, stopping the admission of steam when the piston had made only a part of its stroke, and allowing the rest of the stroke to be performed by the expansion of the steam already in the cylinder. He also made many inventions of important details, as the throttle valve for regulating the admission of steam, the centrifugal governor, the indicator for studying the actions in the cylinder, and, in conjunction with Murdoch, the slide valve for controlling the admission and release of steam. He also patented the use of two or more successive cylinders on one engine, or the modern compound engine plan, which is used in all large engines where economy of fuel is important. Watt's inventive career extended over more than a half-century, and he is rightly called the father of the modern steam engine.

To convert the straight line backward-and-forward motion of the piston into rotary motion, a connecting rod and crank on a fly-wheel are used. Steam engines in English-speaking countries are rated

in horse-power. A one-horse-power engine is one that has the power to raise 33,000 pounds one foot in one minute. This unit of power was adopted because the first steam engines replaced horses in pumping water from the English mines; when the mine owner bought a steam engine, he wanted to know how many horses he could discard. Actually, however, only an unusually strong horse can lift this much.

Developing Modern Steam Engines

The marvelous improvements made in steam engines since Watt's time show strikingly how modern sciences work together to improve man's control of natural forces. In Watt's day, the available metals and workmanship were so crude that he could safely generate and use steam pressures of only a few pounds to the square inch. His condenser made this low pressure usable, by creating a vacuum, against which the steam could push. In 1802 Trevithick patented a method of generating a pressure of 50 pounds to the square inch by turning exhaust steam up the smokestack, thus creating draft enough to maintain a hot fire; but it was not until 1829 that George and Robert Stephenson made such pressures usable by devising a multitubular boiler for their locomotive "Rocket."

This boiler passed the flame and hot air through many small tubes, thereby increasing both the pressure and the amount of steam obtained from the fuel burned. The tubes also helped keep the pressure from bulging the boiler at each end. Iron rods called "stays" gave added strength. This boiler furnished enough power and was at the same time light enough to make steam power practical for railroads (*see* Locomotive; Railroads). A similar boiler, called the *Scotch*, or *marine fire-tube*, type, was developed for steamships by Randolph Elder of Scotland in 1862. At this time the newly-invented Bessemer process for making cheap steel was providing boiler makers with vastly stronger material; so before many years steam pressures up to 250 pounds a square inch could be used.

In 1845 John McNaught made use of the higher pressures then available to revive the *compound* engine invented by Hornblower in Watt's time. This engine used steam in a high-pressure cylinder, and then used the partially expanded steam in a low-pressure cylinder. In 1874 A. C. Kirk combined three cylinders in a *triple-expansion* engine. This engine and the new boilers produced one horse-power an hour from about 1½ pounds of coal in a marine engine, thus making steamships more economical than sailing vessels.

In 1894 the water-tube boiler was introduced. The fire-tube, or Scotch, boiler needed a great amount of water, and "steamed" only after several hours of warming up. The new water-tube type placed the water in tubes bathed in fire, and so almost exploded the water into steam.

At the same time Dr. Wilhelm Schmidt of Germany was developing *superheat*. We know from physics that higher temperatures are needed to produce steam when the overlying pressure is high (*see* Water). Ordinary boilers could barely keep high-pressure steam hot enough to keep it *saturated*—that is, free from condensed water vapor—as it expanded and cooled while working through the engine. Superheating consists of passing the steam through tubes surrounded by fire, until it is several hundred degrees hotter than when it came from the boiler. Then its expansion in working the engine will not cause condensation and loss of power. Use of superheaters in American locomotives gave them about one-third more power for the same weight, and brought the reciprocating, or "back-and-forth," engine to its peak of efficiency.

A final fundamental improvement was invention of the turbine by several men between 1884 and 1897. In the turbine, jets of high-pressure steam blow against blades or vanes, like those of a windmill. At the farther end of the turbine a condenser creates a vacuum, which squeezes a last bit of work from the nearly exhausted steam. The turbine recovers more energy from steam than any other type of engine; but to do so it must run at high speed. Hence it has not been used for engines such as locomotives, which must run at widely different speeds. (*See* Turbine.)

Present-Day Marvels of Steam Efficiency

Although no fundamental changes have been made since the turbine and superheat, great improvements have been made in details. By using modern alloys, boilers have been made strong enough to generate 1,500 pounds of pressure, and more, to the square inch. Some of them are so delicately adjusted that 24 hours of heating is needed to bring them to working temperature, to avoid placing unequal strain upon the various metals used. Preheating of feed-water and air with exhaust steam or hot gas in the stack has increased output between 10 and 15 per cent. Efficiency is increased and labor cut down by mechanical stokers feeding ground coal, systems for blowing pulverized coal into the fire box, and the use of oil as fuel. The best plants, such as those in electrical generating stations, can maintain over 2,500 horse-power an hour with one ton of coal, and recover nearly 90 per cent of the heat energy in the fuel.

How the Steam Engine Works

THE magic of the steam engine is all in a drop of water. How little you think of it as you stand and look into some placid lake, or watch the goldfish in the pond, or see the raindrops trickling from a tree, or see a tear fall from some mother's eye! Yet all this power of steam that drives our mills and factories and engines comes from the simplest thing in all the world—a drop of water.

Without it the earth could never have supported life. For inside a drop of water is the miracle of power, the atom of gas that will do for man the work he cannot do with his own hands. You would think

it strange if some mysterious wizard should wave his hand across the Mississippi and bring out of it the power of a million horses, but it happens every day without the wizard. We light a fire and make the water so hot that the atoms of steam fly for their lives, and in flying they hit against an iron door *and move it.*

That is the magic of the steam engine—as simple as Nature, but too wonderful for human understanding. Let us see how it works; let us take the very simplest engine we can find that goes by steam. It will help us to understand the principle at work in all these other engines—the train that flies across the continent, the engines that plough through the seas, and all those hundreds of kinds of steam engines great and small. One and all, they began with a fire and a drop of water, as we see in these pictures.

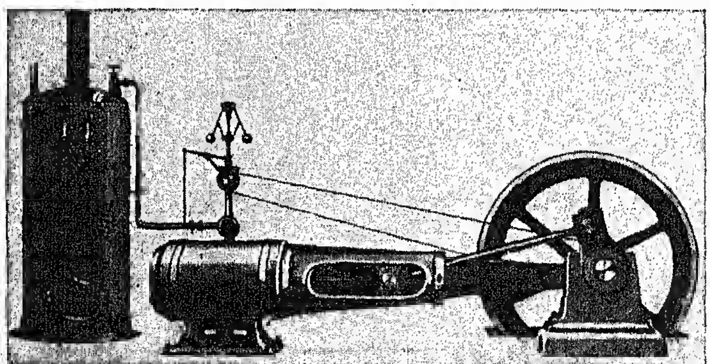
The Steam Boiler

THE STEAM BOILER

What makes a steam engine go? Where does the power come from? It is all done by the expansive force of the gas given off by boiling water. That gas is steam or water vapor. We have all watched the boiling of water in a pan over the fire and seen how, as the water gets hotter and hotter, little bubbles begin to appear over the bottom and sides of the pan, and how presently these bubbles rise and escape into the air. These little bubbles are also water, but water turned into a gas called steam or water vapor. We know that in a few minutes the water will all escape in the form of these bubbles—"boil away" is the way it is commonly described. The bubbles are as clear and colorless as air, and perhaps you have known people who have thought they were bubbles of air. When these bubbles of clear and colorless gas escape into the air, you often see a white cloud appear a little way above the water, particularly if the surrounding air is cold; this white cloud is often called "steam." The white cloud is really a multitude of minute water globules, for the clear invisible steam condenses back into little particles of water when it comes into contact with the cold air. It is such white masses of floating water particles, condensed from water vapor, that we see in the sky as the beautiful clouds of a summer day. When light is reflected from the fine particles of water, they appear white.

Now, how can we get power from this gas? As it escapes from the pan into the air, the steam has no more force than the air. But suppose we put a tight cover on the pan, and watch what happens; presently the cover is lifted by the force of the confined steam. If the cover is fitted too tight, there might be an explosion. That is, when steam is confined, it exerts force in trying to expand. The steam tends to occupy 1,600 times the volume of the liquid water, and that is why it exerts force when it is confined. It is this expansive force or pressure of confined steam that is used to run the steam engine. The water is boiled in a strong steel tank or boiler. The confined steam passes through stout pipes to the steam chest of the engine, where as described farther along, the expansive force or pressure is used to drive the piston back and forth.

There is an opening in the top of the boiler, kept closed by a metal plug held down by a spring or a weight. If the steam pressure gets too high for the strength of the boiler, the plug or valve opens to let the steam escape. Sometimes this "safety valve" is neglected; then there is likely to be an explosion, and the boiler bursts with great force and destructive effect.



The Engine

But why does water in the vapor or gas state, that is steam, exert this great force? Heating water means giving its molecules greater motion, and at 212° F. the motion of the molecules is so great that they no longer hold together, but fly apart. It is the blows of these flying molecules against the walls and the piston that produce the steam pressure. These flying steam molecules pass along the pipe from the boiler into the cylinder, as we see in the next picture.

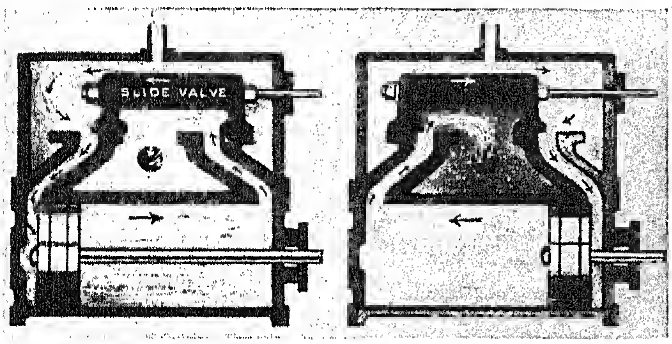
THE ENGINE

In this picture the piston is hidden, but we shall see it in a moment. Here we see the piston-rod, with

the rod that connects it to the fly-wheel, and we see, working from this wheel, the cylinder cord controlling the governor—the two beautifully balanced balls immediately above the cylinder. Simple as this engine is—the simplest form of engine we can have—it is wonderful in the smoothness of its working and the rhythmic balance of its parts.

THE STEAM-CHEST

From the boiler the gas rushes through the pipe into the steam-chest of the engine. It flies to the cylinder till it touches the piston, and here these flying molecules bombard the steel disk so hard that the disk flies back to the other end of the cylinder. Then the engine does a very clever thing. As the piston-rod flies back, another rod flies forward. The cylinder doors are fixed to this other rod; and as the piston goes back the slide valve goes forward, so that the door by which the steam came in is shut. No more steam can come that way. But as this door shuts another opens, and through this open door the steam pours in to drive the piston on again. Let us call these doors the front door and the back. They shut and open hundreds of times a minute. The



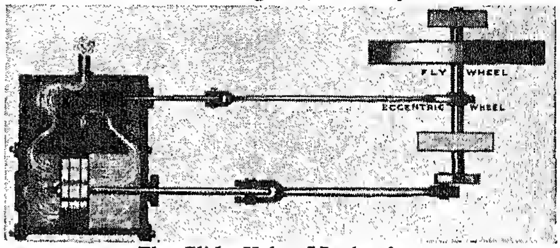
The Steam-Chest

front door opens, the steam rushes through and drives the piston on; then the front door shuts and the back door opens, and the steam through the back door drives the piston back.

No wizard's chest was ever more wonderful than this steam-chest of an engine. Inside it is the secret of the engine that works by steam-power. The ingenuity of its mechanism is well worth studying closely, and these pictures and the picture following make it all quite plain. Not only do the doors shut and open with lightning rapidity and with marvelous precision, but as the piston flies to and fro it clears the cylinder of the used-up gases, driving them into the exhaust-box through the little black hole just under the slide valve.

THE SLIDE-VALVE MECHANISM

Here, looking down on the steam engine, we see how the marvelous exactness of its movements is obtained. We see the steam rushing in and driving the piston through the cylinder. The piston-rod is joined to the connecting-rod, which joins the crank



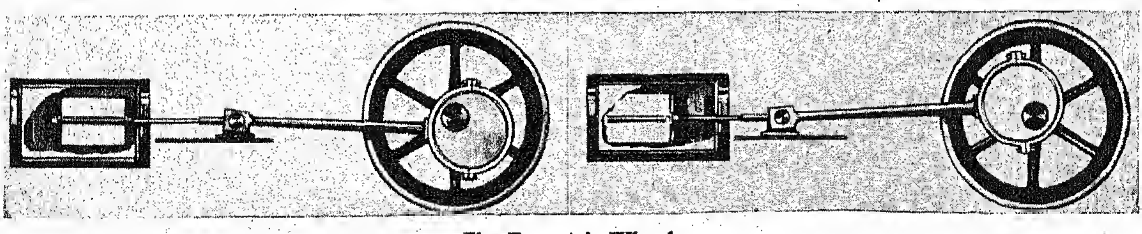
The Slide-Valve Mechanism

of the main shaft so that, as the piston-rod flies to and fro, the shaft goes round and round. In the middle of the shaft is what is called an eccentric wheel—called eccentric because the center of the wheel is not the center of the shaft. The result of this is that the wheel does not run true but has a kind of wobbling motion. The wobble affects the moving of the eccentric rod, which is joined by another rod to the slide valve.

As the piston flies forward the eccentric wheel drives the slide valve backward, shutting the door and cutting off the steam. As the piston comes one way the eccentric wheel drives the slide valve the other way—that is to say, it admits the steam just when it is wanted and where it is wanted.

THE ECCENTRIC WHEEL

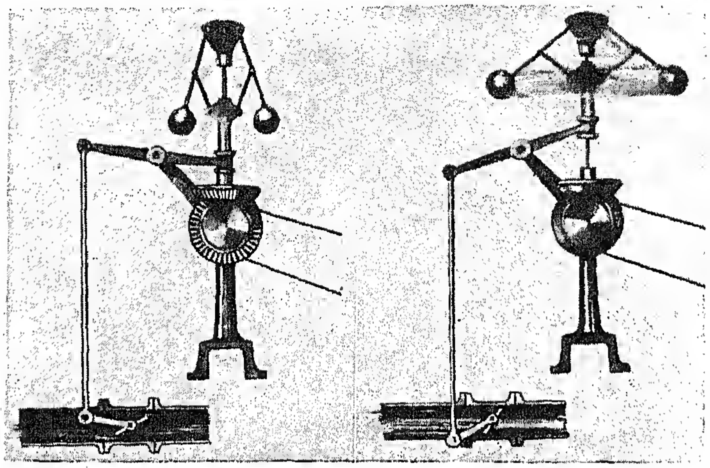
Here we see the eccentric wheel which wobbles out of its center and we see also a top view of the slide valve, or the sliding doors, as we have called them. These two pictures below show how, with the eccentric wheel in one position, the left-hand door is open and the right-hand closed, while with the wheel reversed the right-hand door is open and the left-hand closed. The steam drives the piston, the piston works the shaft, the shaft works the eccentric wheel, and the eccentric wheel works the sliding doors, which control the steam that drives the piston. That is the "round and round" of a steam engine, going on faster than we can count, each part fitting into the other, and each doing its share of the work with untiring accuracy.



The Eccentric Wheel

THE GOVERNOR

These two pictures show one of the most wonderful pieces of mechanism on any engine. It is the little instrument with the hanging balls, and is called the governor. It is connected with the main shaft and is made to revolve by two cog-wheels just below the balls. The faster the main shaft goes around, the faster these cog-wheels and the spinning balls revolve. The governor is like the "sense" of the engine, and its purpose is to regulate the supply of steam to the cylinder.



The Governor

It is all done by the two balls. We all remember the old-fashioned merry-go-rounds on which we used to ride at country fairs. The faster they went the farther out the horses swung and the higher they were in the air. So it is with a ball on a piece of string. Spin it round and round, and the faster you spin it the higher it will rise. Look at the balls in the left-hand picture—they are still and low down. Now look at the right-hand picture—they are spinning around as fast as they can go. As they spin they rise, and as they rise they pull up with them the rod that connects them with the throttle, so that the throttle works with the balls, shutting off steam when the balls are at their highest, admitting more steam when the balls slow down.

This delicate piece of mechanism was invented by James Watt, the inventor of the modern steam engine, and it is called "Watt's ball governor." In most engines now, this governor of Watt's takes another form, though it is really the same in principle. Inside the big fly-wheel of the engine are two big balls or weights fastened on hinged arms. These weights fly out toward the rim of the fly-wheel when the engine is running. Just as in Watt's ball governor there is a rod from the arms of these weights joined to the steam throttle. If the engine runs too fast, the weights fly out so that the rod closes the throttle, shutting off part of the steam, and the engine slows down to the proper speed.

Mercury, which reaches a temperature of 1,000° F. at only 180 pounds pressure, is used instead of water in some turbine engines. After the mercury vapor has operated one turbine, it is still hot enough (about 435° F.) to heat water into steam at 300 pounds pressure, and this water steam in turn operates another turbine. The costly mercury is recovered in a condenser and used over and over. (*See* Mercury.)

STEEL. Any combination of iron, usually with carbon, that is very malleable at high temperatures and can be hardened greatly by sudden cooling, was once called steel. Now the name applies to any malleable iron in a liquid state (*see* Iron and Steel).

STEPHEN, KING OF ENGLAND (1097?–1154). The 19 years that Stephen, grandson of William the Conqueror, reigned over England were one prolonged contest for the crown, with the result that feudal anarchy grew year by year, and the people were sorely oppressed. Although the barons in the lifetime of Henry I had sworn fealty to and recognized as heir his daughter Matilda, widow of the German Emperor Henry V, after his death they chose as King of England and Duke of Normandy the easy-going Stephen of Blois, son of Henry's sister Adele. But Matilda did not let her inheritance slip without a struggle, which she waged with varying success. Her husband Geoffrey of Anjou successfully asserted her claim to Normandy, and after his death their son young Henry of Anjou, the future Henry II of England, took up the contest. Finally in 1153 Stephen, wearied by the unending struggle and saddened by the death of his eldest son, Eustace, for whose advancement he had fought, agreed to the treaty of Wallingford, by which Henry should succeed to the throne after Stephen's death. Stephen died the year after this settlement was made.

In the meantime England had fallen into the greatest misery that ever was her lot. It was the only time when feudalism reigned unchecked in the land. Lawless castles sprang up everywhere, and their garrisons lived by plundering the people. "If three men came riding into a town," says the old English chronicle, "all the inhabitants fled." And again, in speaking of the cruelties practised by the inmates of the "adulterine" castles: "They hanged up men by their feet and smoked them with foul smoke. They put knotted strings about men's heads and twisted them until they went into the brain. They put men into prisons where adders and snakes and toads were crawling, and so they tormented them. Many thousands they starved with hunger." Such horrors lasted the greater part of Stephen's reign, owing to his weakness and the lawlessness of the barons, and were ended only with difficulty by his strong and active successor, Henry II. (*See* Henry, Kings of England.)

STEPHENS, ALEXANDER HAMILTON (1812–1883). Second only to Jefferson Davis among the statesmen of the Confederate States of America was Alexander H. Stephens, the vice-president of the Confederacy. He was a native of Georgia and rose to leadership despite a long fight with ill health and poverty. Like Davis, he had gained his experience in the United States Congress, where he served from 1843 to 1859, resigning then because he "saw that there was bound to be a smash-up on the road and resolved to jump off at the first station."

Like Davis, Stephens opposed secession, making a speech against it before the Georgia legislature in November 1860 and voting against it in the Milledgeville convention in January 1861. When he was overruled in the convention, however, he cast his lot with the South. The next month he was elected vice-president of the Confederacy.

During the war he frequently opposed the exercise of extensive war powers by President Davis, though he had been one of the first to declare that slavery, not states' rights, was the cause of the war.

At the close of the war Stephens headed the Confederate commission which met President Lincoln and Secretary Seward at Hampton Roads, in February 1865, to confer on the terms of peace. He was later imprisoned for six months in Fort Warren, Boston Harbor, but was released upon taking the oath of allegiance to the United States. His devotion to the rights of the negro won for him election to the United States Senate in 1866, but his participation in the war barred him from taking his seat. Then for several years he devoted his energies to the writing of his book, 'A Constitutional View of the War between the States', in which he set forth the Southern position on the doctrines of state sovereignty and secession. This book is generally regarded as the ablest presentation of the Southern point of view. In 1873 he was finally allowed to take a seat in the House of Representatives, in which he served until 1882, when he resigned to become governor of Georgia. He was one of the finest characters and most independent thinkers produced by the Old South.

STEPHENSON, GEORGE (1781–1848). Few great inventors had as humble a beginning as Stephenson. His father, whose earnings never exceeded 12 shillings a week, was fireman of a colliery pumping-engine in the wretched mining village of Wylam, near Newcastle, England. One room in a cottage near the pit-mouth which also sheltered three other families was the home of his parents and their six children. School was not to be thought of; bread was not always to be had in sufficient quantity. In this grimy village he spent his babyhood; childhood saw him below ground. At 14 he was promoted to be his father's assistant at a shilling a day. At 21 he himself was an engine-man at two shillings, with his father under him as a fireman.

Eager to add to his knowledge of engines and steam, Stephenson at 18 entered a night school, learning at the age of 19 to write his own name. His evenings and week-ends were always full of work and study, and his self-improvement brought him steady promotion. At 31 he was "engine-wright" (builder and erector of stationary engines) at Killingworth Colliery or coal-mine, and earning $500 a year—a larger sum then than now—which enabled him to send his son to school. His connection with coal-mines stimulated him to invent a miner's safety lamp, which he perfected about the time Sir Humphry Davy produced his. Meanwhile Stephenson's position permitted him to experiment with the construction and operation of steam engines.

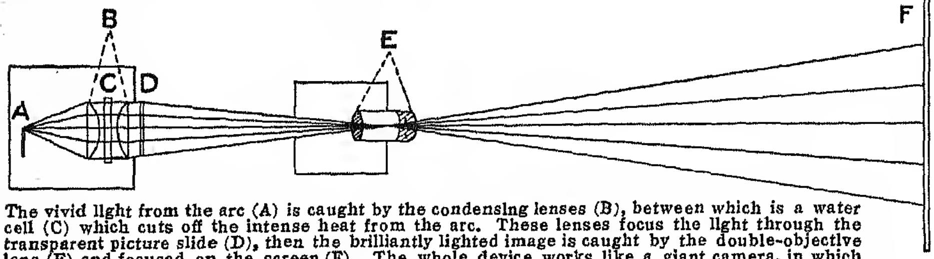
It was then the practice in such places as Killingworth Colliery to lay wooden or iron plates as tracks for the wheels of horse-drawn coal-trucks to run on. Why not use steam instead of horses to pull the trucks? The idea, in fact, was "in the air," and, after seeing experiments of the kind, Stephenson persuaded his employer to back such a project. His first engine, completed in 1814, ran successfully; in his second he improved Watt's engine by turning the exhaust steam into the chimney, thus increasing the draft and doubling the power of the engine. His engine "Locomotion," run over the Stockton & Darlington Railway at its opening in 1825, was the first ever used to draw goods and passengers. His "Rocket" in 1829 won the $2,500 prize offered by the Liverpool & Manchester Railway for the best locomotive engine (*see* Locomotive). Stephenson was now a "made man," and henceforward until he retired to live the life of a country gentleman was the great railroad builder and consulting engineer not only of England but of all Europe. His son Robert (1803–1859) was also a noted international engineer, among whose works are many railroads and famous bridges in various parts of the world. He helped develop his father's locomotive factory and later made the firm of Robert Stephenson and Company the leading locomotive manufacturers in the world, with sales in England, on the Continent, and in America.

STEREOP'TICON. In the 17th century a certain learned Dane showed in Lyons, France, illuminated pictures projected on the wall by a marvelous lantern which some people imagined must have drawn its strange power from supernatural sources. Yet that old "magic lantern" was a rather simple toy compared to the complex apparatus used today for throwing enlarged images on the screens at public lectures, and for projecting moving pictures.

The principle, however, is the same in all "projection apparatus," as such instruments are called. The light passes through a set of large condensing lenses, which gather up the rays and distribute them equally over the transparent image on the slide. After passing through the slide, the beam of light, which is now carrying the image, concentrates upon the smaller objective lenses. These focus the image and project it upon the white screen where it becomes visible. (*See* Lens; Light.)

The slide consists of a piece of glass on which may be lettering, or images painted in transparent colors, or (more often) plain or colored photographs which are exactly like the ordinary photograph except that the gelatine film is supported on glass instead of on paper. In the case of moving pictures, a large number of small photographs, contained on a long roll of flexible film, pass in rapid succession behind the objective lenses (*see* Motion Pictures).

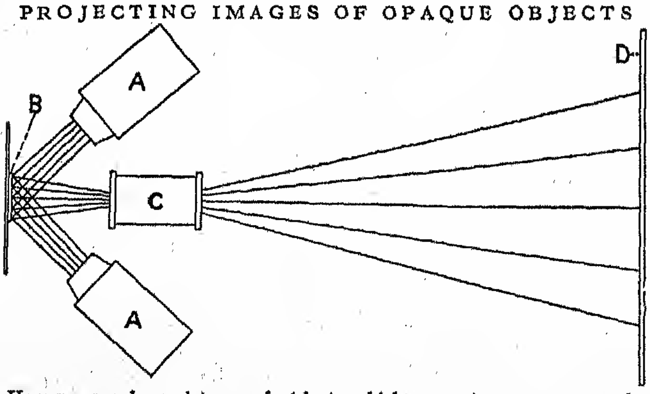
HOW PICTURES ARE THROWN ON SCREENS



The vivid light from the arc (A) is caught by the condensing lenses (B), between which is a water cell (C) which cuts off the intense heat from the arc. These lenses focus the light through the transparent picture slide (D), then the brilliantly lighted image is caught by the double-objective lens (E) and focused on the screen (F). The whole device works like a giant camera, in which the lens "photographs" the image of the slide upon the back of the camera, the room or theater playing the part of the camera box.

To protect the slide or film from the intense heat generated by the light, a water cell is usually placed between the condensing lenses. The light, placed in a box known as the lamp house, must be brilliant and steady. The electric arc is best; limelight makes a good substitute; a Welsbach mantle, an acetylene gas flame, or even a double or triple flame kerosene burner may be used in a small room. More recently special nitrogen-filled tungsten lamps, of from 400 to 1,000 watts, have been successfully used. These can be run from the ordinary 110-volt electric circuits of the home.

PROJECTING IMAGES OF OPAQUE OBJECTS



Here we see how pictures of objects which are not transparent can be thrown on the screen. The two arc-lamps (A) concentrate intense light upon the object (B), and the reflected light from the object is focused by the large objective lens (C) upon the screen (D).

The name "stereopticon" is sometimes applied to a double lantern with the two objectives arranged to focus on the same spot, so that one view may fade into another, or a snow or rain effect may be super-imposed on a clear landscape.

There are several types of instruments for projecting on a screen images of non-transparent or opaque objects. In one of the simplest of these, the "balopticon," the opaque object is intensely illuminated by two lights, each similar to the stereopticon light. The light rays are then reflected back through lenses to the screen.

It is easier to understand the principles of projection apparatus if we compare them to photographic processes. In this case the darkened lecture hall takes the place of the camera. The objective lenses of the projector, just like the camera lenses, are focused upon the transparent slide or upon the brilliantly lighted opaque object, and project its image upon the screen, which corresponds to the photographic plate or film (*see* Photography).

STEREOSCOPE. Of what use is it to us to have two eyes instead of one? Perhaps you think that both eyes see the same object in the same way, but such is not the case. The right eye sees more of the right side of an object, the left eye more of the left side, as you may observe by looking at an object with one eye closed, then the other. The brain puts these two images together and sees them as one (binocular vision). Thus we get our impressions of depth, solidity, or relief.

The ordinary camera has only one "eye" or lens—consequently its photographs appear flat. The principle of the stereoscopic picture is the same as that of the eyes, for it presents two images taken through two lenses. Two photographs of an object or scene are taken simultaneously by a "stereoscopic" camera, so arranged that one lens photographs it from an angle slightly to the right and the other from an angle to the left. These photographs (stereographs) are then mounted side by side on a card.

The stereoscope itself is an instrument with a similar pair of lenses for viewing such photographs. The two images are blended by the brain so that we see a single picture, in which every part stands out solid with lifelike effect.

The principle of the stereoscope (from the Greek words *stereos*, "solid," and *skopein*, "to see") is used in binocular ("double-eyed") field glasses and in opera glasses. There are also binocular microscopes and telescopes, and motion picture films based on the same principle (*see* Motion Pictures). Stereoscopes are modern inventions, the first instrument of the kind having been devised by Sir Charles Wheatstone (1802–1875), English physicist and inventor, in 1832. The open form of stereoscope, which is now commonly used, was devised by Oliver Wendell Holmes, the American essayist and poet, and perfected according to his plans.

STEREOTYPING. Large daily papers are printed with rotary presses which use curved plates. These plates must be made very rapidly. To produce them from flat "forms" containing type and engravings, the process called stereotyping is used. A large sheet of heat-proof papier-mâché is pressed down hard on the form to make a mold of its surface. This is called a matrix or mat. It goes into a caster which curves the mat to a half cylinder. Molten type metal pours in between the face of the mat and the core of the caster, producing a thin, curved plate called a stereotype. Each press cylinder carries two, representing two pages of the paper.

Many stereotypes can be made from the same mat or portion of a mat, and they can be made flat for flat-bed presses as well as curved. Ready-made news "fillers" and syndicate features are supplied in this way to country newspapers. Excellent printing results are obtained with modern stereotypes, and because they are cheaper than electrotypes they are gaining ground in the book and magazine field. (*See* Electrotyping; Newspapers; Printing.)

STEUBEN, Frederic William Augustus (1730–1794). Baron Steuben was a brave German soldier who came to America during the Revolutionary War to aid the Colonial forces. He had begun his military career when he was only 14 years old, and had served in two great European wars before he came to America. As he had been an officer under Frederick the Great of Prussia, the greatest general of the time, he was of inestimable value to the colonists in training their troops.

During the dark days of Valley Forge he turned Washington's body of raw recruits into an efficient well-trained army. He was next sent to the South to "collect, organize, and discipline" recruits, a task he carried out with rare efficiency.

After the war he spent the rest of his life in America. New York, Virginia, Pennsylvania, and New Jersey gave him grants of land for his services during the war, and Congress passed a vote of thanks, gave him a gold-hilted sword, and later granted him a pension of $2,400 a year. He died at his home near Utica, N.Y. His statue stands in Lafayette Square.

STOUT-HEARTED "R.L.S."—*Teller of Tales*

The Story of a Man Who Held High the Torch of Romance and Brave Adventure While He was Fighting a Constant Battle against Death

STEVENSON, Robert Louis (1850–1894). The history of English literature records no braver story than the life and work of the blithe and gifted storyteller, poet, and essayist, Robert Louis Stevenson. Born in Edinburgh, Scotland, he spent much of his childhood in bed, with but the frailest hold on life. He died at the early age of 44. Within a period of 20 years, while waging one long fight with death, he produced an enormous quantity of work of enduring quality. Constant pain and overpowering weakness he did not permit to affect his gaiety of spirit, nor to quench the flame of joy that burns in every line.

His brave spirit and unconquerable cheerfulness are well expressed in the following little poem:

> If I have faltered more or less
> In my great task of happiness;
> If I have moved among my race
> And shown no glorious morning face;
> If beams from happy human eyes
> Have moved me not; if morning skies,
> Books, and my food, and summer rain
> Knocked on my sullen heart in vain:–
> Lord, thy most pointed pleasure take
> And stab my spirit broad awake;
> Or, Lord, if too obdurate I,
> Choose thou, before that spirit die,
> A piercing pain, a killing sin,
> And to my dead heart run them in.

In the autobiographical poems entitled 'A Child's Garden of Verses' Stevenson shows how, shut away from ordinary childish pleasures, he created a wonderful world of romance out of the simplest things. His bed was "the pleasant land of counterpane," not a weariness. His mother read to him the stories which he loved to hear and his devoted nurse Alison Cunningham kept him alive by her tender care. Years later, according to Balfour, his biographer, he told this pious old lady that it was she who had given him a taste for the drama. She indignantly answered that she had "never put foot inside a playhouse" in her life. "Ay, woman," said he, "but it was the grand dramatic way ye had of reciting the hymns."

When he grew older, he was able to take the course in Edinburgh University and to study engineering and law, but no regular study was possible in childhood. So he lived much of the time in a beautiful country home or took journeys with his father, a civil engineer, inspecting lighthouses and harbors about the wild coast. In this way his brain was filled with images of mountain, moor, and sea-girt isles, rather than with the symbols in books. His frail health very early settled the question as to whether he should carry on his father's business of engineering, practice law, or devote himself to literature.

He spent several years in wanderings through France, Germany, and Scotland for the benefit of his health; and records of these journeys were given to the world in 'An Inland Voyage' in 1878 and 'Travels with a Donkey' in 1879. Readers were charmed by Stevenson's delightful conversational manner, by the graceful and easy flow of his style. They did not realize how hard a schooling he had given himself in his preparation for literature, nor how he continued to labor in order to achieve perfection. In 1887 he wrote in a letter, "I imagine nobody had ever such pains to learn a trade as I had; but I slogged at it

day in and day out; and I frankly believe (thanks to my dire industry) I have done more with smaller gifts than almost any man of letters in the world."

With the publication of his first long tale, 'Treasure Island', in 1883 Stevenson became widely popular. He wrote many essays, poems, and short stories, and then in 1886 another absorbing story of adventure, 'Kidnapped'. Stevenson did not concern himself with the problems of life and society, the mysteries of thought and conduct into which George Eliot and Thomas Hardy and other realists of the 19th century delved so deeply. He returned to the pure romanticism of Scott—the love of a story for its own sake, the delight in adventure, the spirit of eternal youth.

STEVENSON ARRIVES AT HIS ISLAND HOME

Here the great story-teller—Tusitala, the natives called him, "teller of tales" —has just landed on the little island of Upolu, where he spent his last years. With him are his wife and his stepson, Lloyd Osbourne.

The great romance of Stevenson's own life began in France in 1876, when he met Mrs. Fanny de Grift Osbourne. Stevenson knew immediately that she was the one woman for him. But there were many difficulties. She had returned to her home in San Francisco when Stevenson, hearing that she was ill, decided to follow her. He crossed the Atlantic in the steerage and the continent in an emigrant train. The experience gave him material for several books but, together with the hard times he suffered in San Francisco, nearly killed him. He developed tuberculosis and would have died, had it not been for Mrs. Osbourne, who nursed him back to health. In 1880 they were married, and Stevenson returned with his wife and stepchildren to Scotland, where they were welcomed into his father's home. The stepson, Lloyd Osbourne, collaborated with Stevenson in some of his stories and later won considerable distinction as a writer on his own account.

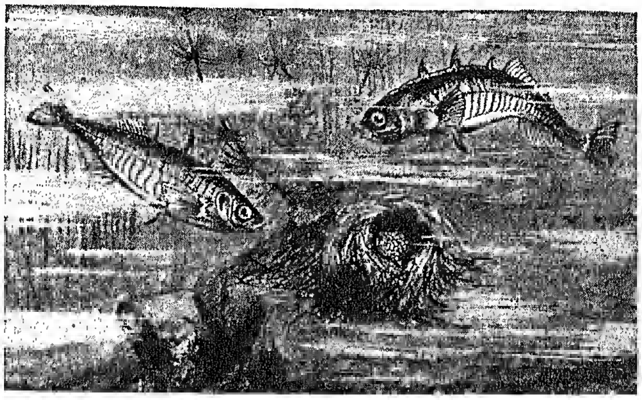
Stevenson could not stand the severe climate of Scotland and so for years he wandered from place to place in search of a climate where he might live and work. At last he settled with his family in one of the Samoan Islands in the South Pacific. Here he gained four more years of life and of fairly good health. The end of the brave struggle came quite suddenly in 1894. While talking gaily on the veranda of his house at Vailima he had a stroke of apoplexy from which he never recovered consciousness. The natives, who had come to regard him as their beloved chief, carried his body to Mount Vaea, cutting a path to the summit with their knives and axes. There they buried him and there he lies today in the green place of trees and birds and windswept solitude, with one of his brave verses for an epitaph:

Under the wide and starry sky,
Dig the grave and let me lie.
Glad did I live, and gladly die,
And I laid me down with a will.
This be the verse you grave for me:
"Here he lies where he longed to be.
Home is the sailor, home from the sea,
And the hunter home from the hill."

Stevenson's best known works are: 'An Inland Voyage' (1878); 'Travels with a Donkey' (1879); 'Virginibus puerisque' (1881); 'Familiar Studies of Men and Books' (1882); 'New Arabian Nights' (1882); 'The Silverado Squatters' (1883); 'A Child's Garden of Verses' (1885); 'Prince Otto' (1885); 'The Strange Case of Dr. Jekyll and Mr. Hyde' (1886); 'Kidnapped' (1886); 'The Merry Men, and Other Tales', including 'Markheim' and 'Will o' the Mill' (1887); 'The Master of Ballantrae' (1889); 'The Ebb Tide' (1893); 'David Balfour' (1893); 'Weir of Hermiston' (unfinished).

STICKLEBACK. The life of this little fish is short, but full of excitement. At the age of three years he has lived out his time, but he usually dies as he lived, by the "sword" which he and his kind carry on their backs. He is a tyrant, cruel toward the weak, insolent toward the strong, always seeking a fight, and usually finding it. Yet the male stickleback combines with his ferocious fighting qualities a great domestic virtue. It is he who builds the tiny nest in which the female lays her eggs, and it is he who guards it jealously until the young are hatched.

THE STICKLEBACK DEFENDING HIS NEST



If you don't want trouble, you'd better keep out of the Stickleback's front yard; for that little home nest under the water is the dearest place in the world to him and he will defend it with his life!

Sticklebacks occur throughout the north temperate zone, along seacoasts as well as in fresh-water streams. They are short-lived and generally grow to be only three or four inches long, but they carry sharp spines or thorns on their backs, which are formidable weapons against fish much larger than themselves. During the first year of their lives, they gather in small friendly groups. But with the return of the next summer, each male selects a territory which he fiercely defends against all comers, fighting other intruding males to the death. In these duels the sticklebacks dart at each other, striving each to get the position of vantage which will permit him to rip open with his sharp spines the abdomen of his foe.

Once established as master of his territory, the male stickleback builds his tunnel-shaped nest, binding bits of water weeds together with a tough white thread which he produces from an internal gland as a spider does its web. Then he assumes his bridegroom's dress of blue and red tints, and invites several female sticklebacks to stock his home with eggs. When the nest is filled, he enters it and mounts guard, his head thrust out to watch the enemies. If a big fish or even a man's hand approaches, he sallies forth with spines erect to give battle. So successful as a rule is he that he is shunned by all.

But jealous as he is of his own rights, he has no respect for those of others. He delights particularly in eating the young of other fish, and his capacity is enormous. A small stickleback in an aquarium has been known to devour in five hours' time 75 newly hatched dace, each about one-quarter of an inch long.

There are several species with varying numbers of spines. The common species (*Gasterosteus aculeatus*) has three or four, while the sea stickleback (*Spinachia vulgaris*), which attains a length of seven inches, is armed with 15 spines. The brook stickleback (*Eucalia inconstans*), which is abundant in small streams from New York to Kansas, grows only two and one-half inches long, but has five short spines.

STOCKHOLM, SWEDEN. Broad swirling streams of shining blue water, with hundreds of little steamers and ferry-boats darting to and fro like water-bugs on a pond; miles of spacious docks, quays, and terraces stretching along the twisting waterways; fine wide boulevards and spacious stone-flagged public squares; many glimpses of green parks, bright flowers, and stately trees showing here and there in the long vistas of handsome buildings; the whole framed in a background of black primeval forest stretching almost to the city's edge—these are some of the impressions that crowd in on the traveler when he arrives at Stockholm, the capital of Sweden.

"The most beautiful capital in Europe" and "the Venice of the North" are phrases often applied to this city of the northland—so far north that it is almost on a line with the farthest tip of Labrador. Stockholm lies on a group of hilly islands and peninsulas in the midst of a veritable labyrinth of fiords and bays, streams, and straits. One-seventh of the space within its limits is occupied by water, and in traveling from one part of the city to another, one is as likely to take a steamer as a street-car. Water is in sight, it is said, from half of all the houses of the city, and there seem to be more quays and sea-terraces than streets.

But the similarity to Venice ends there; for unlike Venice, where the whole city lies on a level with the water, many of the streets of Stockholm are so precipitous that elevators or steps are used to get from one street to the next above, and tunnels are built from street to street through the solid rock, which crops out in great bare ridges in the most unexpected places.

Much of Stockholm's charm comes from the profusion of trees and gay flowers that embower it, more than one-fourth of all its area being given over to parks and gardens. And if you should happen to visit it on Midsummer Day (June 24), you would find the whole city a mass of verdure. For that is the gladdest, gayest holiday of all Scandinavia, when the delicate drooping branches of the birch, clad in their fresh green livery, are hung out from every doorway and every window, and even adorn the horses. At night huge bonfires—twice the height of a man—are kindled, setting the sky in a glow that is seen far and wide. All is color and song and merrymaking in honor of the fleeting summer, prized all the more because of its short span. And brief though it is, the people of

Stockholm make the most of it, spending their evenings in the parks and gardens and open-air cafés listening to music until the sharp chill—never absent from the night air even in mid-summer—drives them shivering home long before the last gleams of the lingering twilight of the north have faded from the midnight skies.

Some Historic Landmarks

The city falls into three principal sections, as we see if we take our stand on the Norrbro (North bridge), the handsome granite structure which links the modern business section of the city to the north (Norrmalm) with the island Staden, where the old city was founded in 1255. Between Staden and the northern district, with its many fine public buildings, lies the little Holy Ghost Island, on which is located the splendid new Parliament Building.

Looking south toward Staden, we see in a corner of the island the Royal Palace, one of the stateliest royal residences in Europe. Near the palace is the old St. Nicholas Church (1264), where the kings of Sweden are crowned, and beyond this is the Stortorg (large market), where in 1520 occurred the terrible massacre of nobles ordered by King Christian II of Denmark, called the "Stockholm Blood Bath." West of Staden on a little island is Sweden's chief temple of fame, the Riddarholm Church with its perforated iron spire 295 feet high. Except when a member of the royal family dies, no services are held here; for since the time of Gustavus Adolphus (1594–1632) this church has been the burial place of the royal family. From the south end of Staden, two iron bridges lead to Södermalm, an old southern quarter of the city, whose steep rocky heights rise 120 feet above the water's edge.

An Open-Air Museum

Looking east from the Norrbro we see another island (Skeppsholm), the headquarters of the Swedish navy. And beyond it rise the beautiful wooded heights of the island of the Djurgården or Deer Park. Here is Skansen, the picturesque and interesting 70-acre park illustrating the fauna and flora as well as the habitations and costumes of the peasants in the different parts of Sweden.

Stockholm is the chief cultural as well as the industrial and commercial center of Sweden. It is the seat of the principal learned societies and royal academies, as well as of the Caroline Institute, the leading medical school of the country, and the University of Stockholm. There are technical schools giving courses in agriculture, forestry, mining, engineering, etc., and renowned museums of art, antiquities, natural history, and anthropology.

The city has a good harbor, which is kept open by ice breakers during the winter months. It is noted for its iron and steel products: dairy machinery, bridges, engines, turbines, and pneumatic tools. Other industries include shipbuilding, tanning, manufacturing of textiles, and pottery. Population, over 500,000.

STOCKS AND BONDS. So much money, or capital, is needed to start a large business that funds usually must be obtained from many persons. This is commonly done by the sale of stocks and bonds, a method of finance that began in the 17th century. Thus was the way paved for the Industrial Revolution, for this method enabled men to undertake costly enterprises, such as building factories (*see* Industrial Revolution).

Suppose $5,000,000 is needed to start a large-scale manufacturing business. The promoters form a "joint stock company," or stock corporation (*see* Corporations). This company then issues a number of certificates, say 50,000. These are called stock certificates. Each represents one share in the company, and is offered for sale at $100. This amount may be stated on the certificate as the "nominal," or "face," or "par" value of the share. Here, however, "value" does not strictly mean money. Instead, it should be considered as the fraction of the company's property and profits to which one share entitles the buyer—in this instance, 1/50,000.

The buyer, or "stockholder," becomes a member in the company. He usually has a right to one or more votes, depending on the number of shares he bought, in selecting the directors of the company, and in determining its plans. If the company makes profits, the directors usually "declare a dividend"—that is, they divide part of the profits among the stockholders. The "undistributed" profits are kept for future needs of the business. If all profits are thus held, stockholders receive no dividend. Likewise, if a company makes no profit, there is no dividend.

Dividends are commonly paid quarterly, semiannually, or annually. If profits are high, the directors may pay an "extra dividend." When a company acquires new assets, it may declare a "stock dividend" and distribute more shares of stock instead of money.

Why "Par Value" Differs from "Market Price"

Because the dividends earned by a share vary, the money value, or "market price," of the share also varies. A share bought at par value of $100 may earn such large dividends that the stockholder can sell it for perhaps $200. Or it may earn nothing or so little that it cannot be sold at any price. Thus the par value of a stock may not be identical with its market price. To avoid confusion, many companies issue their stock at "no par value."

The type of stock thus far described is "common stock." But part of an issue may be "preferred stock." This ranks ahead of common stock in division of assets, if a company fails; or in payment of dividends, or in both assets and dividends. Before dividends are paid on the common, they must be paid on preferred at a specified per cent of its par value. A 7 per cent preferred stock bought at par value of $100 can earn a dividend of $7. But it earns no more even if profits are large. "Participating preferred," however, can earn dividends at the specified rate and also share with common stock in remaining dividends. But "cumulative preferred" outranks all stocks in divi-

dend rights. If dividends have been "passed" (not paid) and then are resumed, the dividends past due on cumulative preferred must be paid before any are given to other preferred or to common. Preferred stock may also be "1st" or "2d" or "3d" preferred. In claims to assets or to dividends, "1st" preferred outranks "2d," and so on. Preferred stock does not usually have voting rights.

Important Facts about Bonds

When a company wants money for temporary use, such as use in business expansion, it *borrows* funds. This may be done by issuing preferred stock with provision to "retire" the stock; that is, to return the money at a fixed or optional date, and take back the stock. But commonly such loans are obtained by issuing *bonds*. These are written promises to repay the borrowed money at the end of a specified period. Usually the company also promises to pay interest meanwhile at a specified rate. Bondholders receive this interest before dividends are paid on any stock.

Instead of promising to repay the entire loan at one time, the company may repay, or "retire," some bonds each year. The bonds thus to be repaid are usually chosen by lot and are called serial bonds. If either bonds or stock are sold with provision that they can be rebought by the company at a specified price, they are said to be "callable" at that price.

Bonds are usually secured by a mortgage on part or all of a company's property. A company may mortgage property for only part of its value, and issue an equally small amount of bonds at first. Later, when more money is needed, the company may place a "second mortgage" on the property, and issue "second mortgage" or "junior lien" bonds. These rank below "first mortgage" or "senior lien" bonds in claims.

Failure to pay interest on bonds or to repay the principal formerly meant that the mortgage usually was foreclosed, and the assets sold for the benefit of the bondholders and other creditors. Thus the company lost its property. Stockholders, moreover, seldom were paid anything from the forced sale. But in 1934 the federal bankruptcy law was amended by Section 77B. This enables a sound company, in temporary difficulty, to petition a federal court for permission to reorganize. If the reorganization plan is approved by a majority of the bondholders and other creditors and of the stockholders, and by the court, the company continues without foreclosure.

Instead of property or equipment, stocks or bonds may be used as security for a mortgage. Bonds thus secured are "collateral trust bonds." When a company wants only a short-term loan, it may issue "notes" and "debentures" (from the Latin word "owing"). These two types of certificates usually are not secured by mortgage, but the debenture normally specifies that it will be secured if the company assumes new debt. Many short-term bonds secured by mortgage are also called "notes." Before the world depression that began in 1929, many "gold bonds" were issued. These were promises to pay the principal and interest in gold. But when nations went off the gold standard, this provision became meaningless.

Because of the mortgage security, bonds are considered a safer investment than stock. But the rate of interest is less than the dividends on stock in a prosperous company. (For computing interest or "yield" on bonds, *see* Percentage and Interest.) Bonds are also issued by cities, counties, states, and national governments as a way of borrowing money. Because such bonds are supported by tax funds, they are usually among the safest investments a person can make. "Savings bonds" issued by the Federal government have become a popular investment. Instead of paying interest at specified periods, they are sold at a discount. Thus a bond which matures in ten years for \$25 is sold at \$18.75. For brief needs, governments as well as corporations sell notes payable in a few months. This is "short-term financing," and such obligations form a part of a "floating debt."

Factors to Consider in Buying a Bond

The purchaser of a bond should consider at least four factors: safety, yield, earnings, and market. For safety, the value of the mortgaged property should be higher than the amount of the total bond issue, because foreclosed property is sold at a sacrifice. The yield, or rate of interest, should be equal to the current rate for sound investments, which any broker can tell you. Earnings of the company should be enough to meet interest payments on its bonds and other obligations, as well as to repay maturing loans and to cover expenses of business operation. An active demand, or "market," for bonds of the issue you hold makes it easier for you to sell your bond if you should need the money.

Companies keep a record of stockholders, and often provide that, if the stockholder wishes, no transfer of his stock will be recognized until after he has notified the company. This protects the owner against loss by theft and similar causes. Many companies also give this safeguard to bondholders. Such securities are said to be "registered."

It is usually impossible for a corporation which has stock or bonds to sell to reach the thousands of investors who might be interested. In the case of good properties, therefore, the promoters of the company usually sell the entire issue outright to a group of financiers who have combined to purchase it. Such a group is called a "syndicate." The syndicate then conducts the sale throughout the country.

So far we have considered only the purchase of stocks and bonds as the company issues them. Often, however, a person may want to sell his securities. If they are "listed securities," they can be sold and bought on a "stock exchange," which serves as a market place for stocks and bonds. To list a stock, a company must meet the requirements fixed by the governors of the exchange, such as requiring a company to file financial statements regularly. Since listed stock carries some prestige, many new companies try to meet the requirements, paying a fee to have their

stock listed on one of the large exchanges—usually the one in New York. This, next to that in London, is the largest stock exchange in the world.

Wall Street, where the New York Stock Exchange is situated, is the chief center of buying and selling the stocks and bonds of American industries. The Exchange limits its membership, and a membership, or "seat," commands a high price when it changes hands. Only members can buy or sell on the Exchange, but any banker or broker can deal through a member, paying him a small percentage called "brokerage" (*see* Boards of Trade). The investor, or customer, in turn buys or sells through a broker. A vast network of wires to other cities enables brokers and investors everywhere to learn the prices, or "quotations," on securities almost as soon as they appear on the ticker of the Exchange.

The two methods of buying or selling are "outright" and "margin." In margin transactions, the customer furnishes only a part of the funds to buy or sell a stock, and the broker provides the rest. But when stock is bought on margin, it is not issued in the customer's name. The broker retains the right to sell the stock if the market price falls to a point where he would lose the money he advanced.

Many usually less-known securities, not listed on the New York Stock Exchange, are dealt in on the "curb market." This is so named because until 1921 it had no building, but transacted its business on the sidewalk of Broad Street, near Wall Street. Securities may also be listed on stock exchanges of other cities, but these smaller exchanges deal largely in securities of local companies. Many "unlisted" stocks are dealt in on the curb market, and they are also bought and sold "over the counter"; that is, they are dealt in directly by brokers, without services of a stock market.

By means of "blue sky laws," states seek to protect investors from being sold fraudulent stocks or stocks so worthless that they have no assets but the "blue sky." In 1934 the Securities and Exchange Commission was set up by federal law. The commission regulates all stock exchanges. It demands financial reports from every company issuing stocks, and holds the company and brokers liable for advertising statements. Thus, though merit of the investment is not determined, the buyer is informed about the company. The commission also limits short selling and margin buying. In 1940 another step to protect the investor was taken when the commission was put in control of investment trusts and of investment counselors. (*See also* Trusts.)

STOMACH. When you swallow a mouthful of food the first stopping place of that food is the stomach, an irregular cone-shaped bag, which is one of the principal digestive organs of the body. When it is empty it hangs almost vertical; when filled it swings obliquely or crosswise in the abdomen.

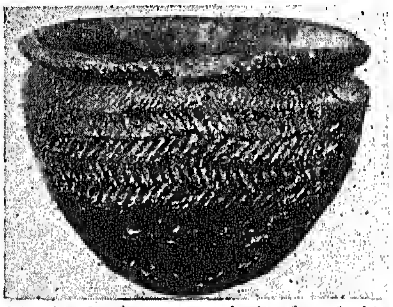
Four layers of tissues called coats, or tunics, form this bag. From the inside out they are the mucous, submucous, muscular, and serous. The muscular coat makes this bag very elastic. Ordinarily it is about 12 inches long and four inches across, holding about three pints. However, the ability to stretch enables it to hold larger quantities of food and drink. There are two openings into this bag: one at the top, opening from the gullet (or esophagus), called the "cardiac orifice" and the other opening into the small intestine, and called the "pyloric orifice."

In the mucous lining of the stomach are found certain cells or glands whose business it is to manufacture the gastric juice. This is one of the digestive fluids and is made up largely of water, salts, hydrochloric acid, pepsin, and rennin. The peculiar churning movement of the stomach mixes the food with this liquid which dissolves it and also changes certain parts of it. (*See* Digestion.) If these gastric glands fail to produce the proper kind of juice, we have indigestion. A sour taste in the mouth indicates too much acid; a sweetish taste, too much pepsin. If we exercise care in eating we need never have that disagreeable experience called stomach-ache.

Much of what we know about the stomach and the gastric juice is due to the careful observations made by a United States army surgeon named Dr. Beaumont. At his army post on Mackinac Island, in 1822, he had as a patient Alexis Saint-Martin, whose stomach had in it an unhealed gunshot wound. His general health was unimpaired, and by keeping the body wound open, Dr. Beaumont was able for years to watch the stomach at work.

STONE AGE. A rough stone picked up by the river's edge was the first weapon and the first tool used by man. Scientists tell us that this happened about 300,000 years ago. Whenever it was, we may imagine a man climbing down from his tree home, and finding a nut too hard even for his strong teeth. He picks up a stone and crushes the nut. Perhaps it is not fit to eat. But he forgets that in the joy of having invented the first hammer.

A NEW STONE AGE RELIC



The hands that so cunningly shaped this bowl, with its graceful curves and herringbone decorations, withered into dust untold centuries ago; for this bowl, dredged up from the River Thames, dates from the far-off Neolithic times when our remote ancestors had just learned to make pottery.

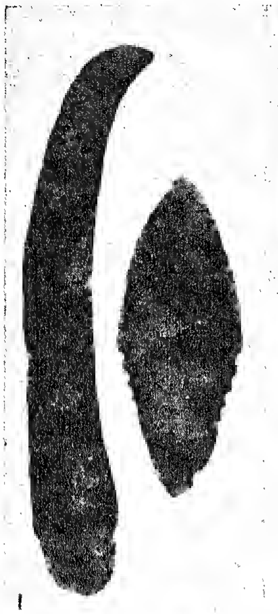
Then man began gathering stones, round ones to throw at birds and small animals, and heavy ones to crack oysters and nuts. Perhaps he cut himself with a sharp stone and so discovered the first knife or hatchet.

Some thousands of years later, the descendants of these early tree dwellers became dissatisfied with the shape of their stone tools and weapons. One of them succeeded in chipping a piece of flint into a more useful shape. He is the first great inventor. With him began what scientists call the Old Stone Age or the Paleolithic Age.

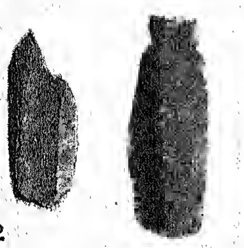
The discovery that flint would flake off leaving sharp edges must be ranked as one of the great discoveries of that early world. It enabled man by means of his improved weapons to wage a successful battle against wild beasts, and to obtain food by hunting large game. Thus he developed the energy and confidence which enabled him to make further steps forward in civilization.

For perhaps 150,000 years the rough chipping of flint for spears and hatchets, knives and arrows, continued. The workmanship became finer and new tools were invented for scraping flesh from skins and for drilling and cutting bone and horn. Soon these last materials began to be used for weapons, along with

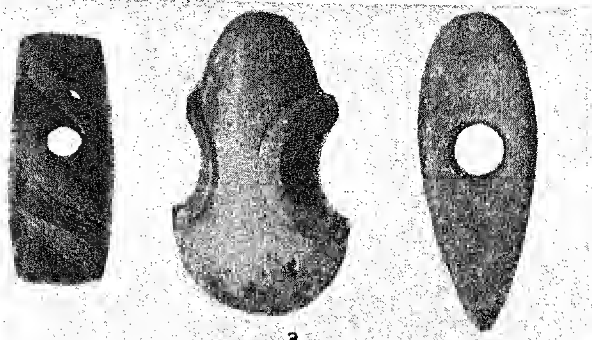
MUTE MEMORIALS OF THE ROCKY PATH OUR FOREFATHERS TRAVELED



1

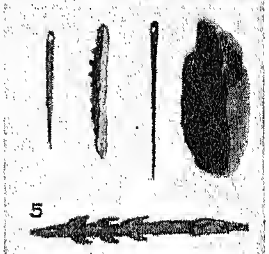


2



3

4



5

When these implements were made, men had already taken several great strides along the rocky path of civilization. The flint knives and arrow heads shown in 1, 2, and 4 are great improvements over earlier implements, for they have been chipped by pressure. Flint is so brittle that bits of it will snap off when a hard piece of bone is firmly pressed against it. This process, one of the triumphs of the New Stone Age, produces a far keener cutting edge than the older method of chipping flint by blows with another stone. The polished stone axes and hammers (3) and the bone needles and harpoons (5) give further evidence of the progress of this period.

stone. Rude fish-hooks were made, and arrows with barbed points. This was the age of the Cave Men (*see* Cave Dwellers). Later still came the New Stone or Neolithic Age, when men learned to grind and polish the rough edges of their flint tools and weapons so that a knife would cut more easily and a spear be driven into an animal more surely. Last came the discovery of metals, chiefly copper and tin, which ended the Stone Age altogether and ushered in the Age of Bronze.

It is largely through the study of such old flint weapons found in all parts of the world that scientists are able to trace the story of early man. But in many parts of the world the use of stone implements continued into modern times, and the American Indians were using stone pointed arrows when the white men first came.

Among the relics which are believed to date back to the Stone Age are the monuments of huge rough stone found in great numbers in many parts of the world. They consist usually of large single stones (menhirs) set on end in the midst of a plain, or of groups of such stones (cromlechs) arranged in circles or squares, or of stones set side by side with a third stone bridging the top (dolmens).

Often these monuments show signs of having been rudely hewn by the prehistoric architects, and occasionally drawings and carvings of mysterious symbols appear upon them. Many of them are believed to mark the burial places of noted chiefs, while the "circle-stones" may have been meeting places of the skin-clad clans. Great Britain and France are particularly rich in these relics, the most famous of which is the combination of "circle-stones" and dolmens called Stonehenge, on Salisbury Plain, England. Northern Africa, India, South America, and even some of the tiny Pacific islands have important examples of this earliest form of the builder's art.

Frequently these monuments stand far removed from any stone deposits. How such huge blocks were transported and set up by primitive men will probably always remain a mystery. Some monuments of this kind have been traced to the Bronze and Iron ages, but they are usually much smaller than those ascribed to the Stone Age. (*See also* Man.)

STORAGE BATTERY. The electricity that starts the engines and operates the lights of our automobiles is supplied from storage batteries. Electric delivery trucks run entirely on the current supplied by storage batteries, as do submarines when they are traveling under water. Storage batteries light our trains. They are used in switchyard locomotives and in the little locomotives and trucks that carry the heavy loads at wharves, freight depots, and industrial plants. They run portable and farm radio sets. They supply emergency current for electric lighting stations in case the generators break down or the peak load becomes too heavy.

In all batteries chemical energy is turned into electric energy (*see* Electric Battery). The distinctive feature of the storage battery is that its chemical energy, once used, can be restored. The commonest form of storage cell contains dilute sulphuric acid in which positive lead plates coated with peroxide of lead are spaced alternately with negative

plates of spongy metallic lead, with separators, usually made of wood, between them. Each such cell yields about two volts, the usual 6-volt battery consisting of three cells sealed together in a glass or rubber case, with a ventilating cap over each cell, which can be removed to test the battery or to replace water that may evaporate from the solution.

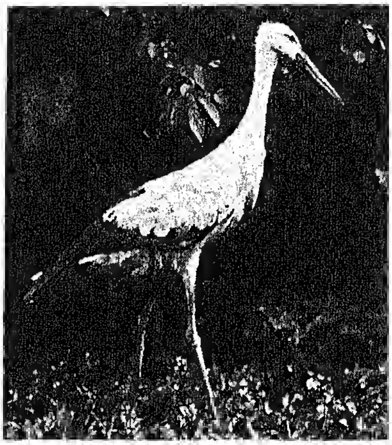
When the battery is discharging, lead sulphate is formed on the plates, the acid solution growing weaker. To recharge the battery, a direct current from another source is connected—positive to positive and negative to negative—so that electricity flows back through the battery in reverse direction. This restores the chemicals to their original condition. The hydrometer test of the solution shows a specific gravity of about 1.15° when discharged, 1.30° when fully charged. (*See* Hydrometer.)

The Edison storage battery has positive plates in which the active material is nickel hydrate, and negative plates in which the active material is iron oxide. The electrolyte is a solution of caustic potash. Each cell develops an average of 1.1 volts.

The SOLEMN FISHERMEN *of the* MARSHES

Birds that Walk on Stilts—Voiceless Courtship of the Stork—His Grotesque Ideas about Dancing—The Adjutant's Military Strut—Long Flight of the Cranes

STORKS, HERONS, AND CRANES. "Stilt-walkers" is a term that describes these wading and marsh-dwelling birds, for balanced on their long slender legs they are able to go about through the muddy slime of the swamp and yet keep their beautiful plumage in immaculate condition. They are found in most parts of the world, generally along shores or muddy flats. They feed on fish, small water creatures, and water plants, and most species eat also meadow mice and some seeds.



The White Stork, beloved by European children and grown-ups, is conspicuously garbed in black and white.

The 19 known species of the stork family (*Ciconiidae*) are distributed over the world. Three species occur in the Western Hemisphere. The common white stork of Europe, the bird fabled to bring the babies and the hero of many folk-stories, is found during the summer in most of the countries of Europe. It breeds from southern Sweden to Spain and Greece, and winters in Africa and India. Its favorite nesting place is on the roofs of tall buildings; and on many housetops in Denmark, Sweden, and Holland, platforms are erected to induce the stork to build there. The birds return to the same nest year after year, each season adding to the rough sticks composing their nest, until the pile sometimes reaches a height of several feet.

In Europe storks are carefully protected, which accounts for their friendly confidence in human beings. The tall bird, with its white plumage, set off by the black wing quills and red beak and legs, is a beautiful sight as he stalks about the meadows searching for his supper. The stork has no voice, and during the mating season, when other birds express themselves in song, he goes through the most grotesque antics, leaping, bounding, and wildly flapping about with chattering beak.

A QUEER BIRD WITH A QUEER NAME

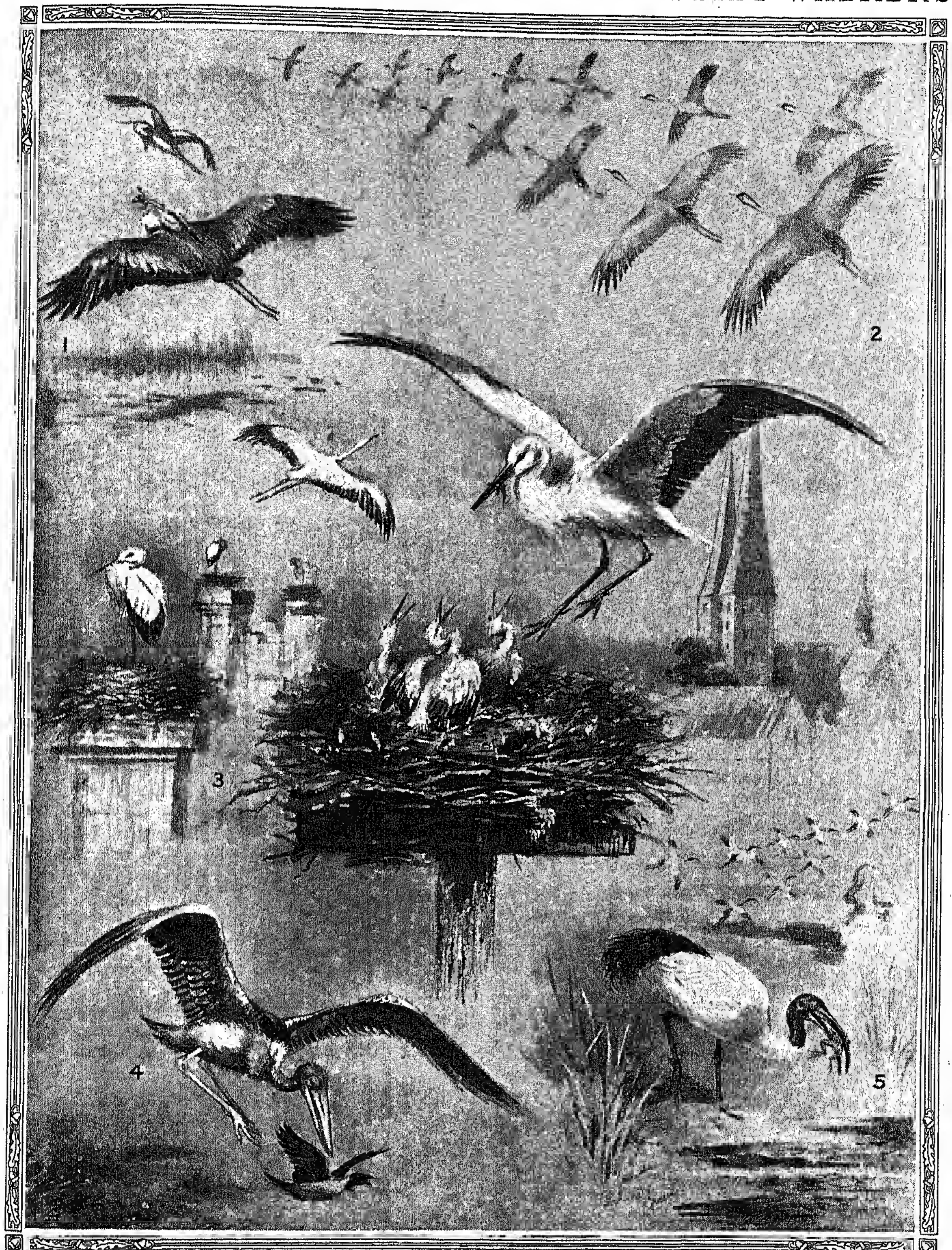
No wonder the Arabs of the White Nile, where he makes his home, call this stork "Abu Markub," for it means "father-of-the shoe." Other names are "Shoe-bill" and "Whale-headed Stork."

The adjutant stork of India, a large bird about 5 feet long with a wing span of nearly 14 feet, receives its military title from its stiff soldier-like attitude and measured strut. Its plumage is slate-colored above and grayish white beneath. Unlike most storks, the adjutant is a carrion feeder. In villages and towns of India it is a familiar sight as it stalks freely about the streets acting as a scavenger.

A closely related species is the marabou or adjutant stork of Africa. The soft white coverts of its under-wing and tail furnish the marabou feathers sometimes used for trimming women's apparel. The term marabou, however, is loosely applied to many other kinds of soft feathers.

The wood ibis, also called the wood stork, is the only member of the stork family found in the United States. This bird is about 40 inches in length, with white plumage except for the glossy black wing and tail feathers. The head and neck are bare. It breeds in colonies along the Gulf coast from Texas to Florida and north to South Carolina. After the breeding season it sometimes wanders north to Montana, Wyoming, Illinois, New York, and other northern states.

SNAP-SHOTS AT THE FEATHERED STILT-WALKERS



Here are various interesting episodes in the lives of the stilt-walkers in feathers: 1. Common Herons in flight from a feeding ground. 2. Cranes in wedge formation in migration time. 3. The white Stork comes home with dinner. In the background are several others, standing about on one leg, and surveying the landscape from chimney tops. 4. An Adjutant of southern Asia about to catch a hooded crow. 5. The Sacred Ibis of Egypt dines on frog.

Close relatives of the storks are the ibises, which with the spoonbills form the family *Threskiornithidae.* The 30 known species are distributed over the warmer parts of the globe; three inhabit North America. They are gregarious birds, living in flocks during the entire year. They are smaller than the storks, and have bare faces and long down-curved bills. The white ibis breeds from southern Lower California, Texas, Louisiana, Florida, and South Carolina down to South America. This handsome wader is pure white except for the black-tipped flight-feathers. Its long bill, bare face, and legs are deep yellow. It is about 25 inches in length. Often hundreds of these birds nest in a single colony. Their crudely fashioned nests of reeds and sticks are built in trees, shrubs, and reedy marshes.

THE MONARCH OF THE HERONS

The Great Blue Heron who is here displaying his royal wings is one of the largest of American herons and a most stately and dignified bird he is. You should see him fish! Standing in the water, still as a statue, with his long neck doubled into a capital "S," let a frog swim within range and with a stroke quicker than your eye can follow the frog has been seized in that long bill. In another second he has disappeared; and again the statuesque pose.

The white-faced glossy ibis is common in parts of the western United States, breeding from Oregon and Utah to Texas and Mexico. This species is about 24 inches in length, and except for its white face has rich chestnut-colored plumage. The scarlet ibis is a rare South American bird with brilliant red plumage. It has been reported several times in the southern United States.

This Black-necked Stork ranges from India to Australia and New Guinea. In contrast to its white body, it wears iridescent black and bluish-green feathers on the head, neck, wings, and tail.

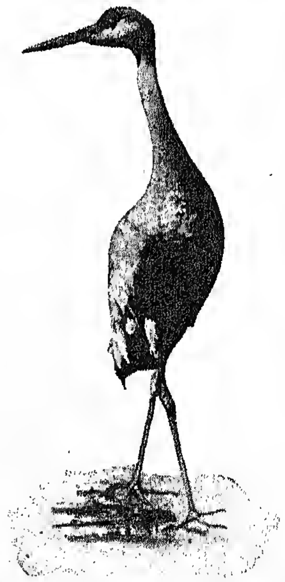
The sacred ibis (*Ibis aethiopica*) inhabits the Nile valley, where it feeds along the mud flats and nests in trees and shrubs with others of its kind. This black and white bird was revered by the ancient Egyptians, who regarded it with superstitious awe and embalmed it at its death.

The six species of spoonbills are distributed over the tropical and subtropical areas of the world. Only one, the roseate spoonbill, is found in America. Their flattened and broad, spatulate bills distinguish them from the ibises. In feeding they bury the bill in the water and swing it from side to side in search of food. The roseate spoonbill is a magnificent bird about 32 inches long, with pink and white plumage. Although formerly abundant, so completely has it been killed off by plume hunters that only a few stragglers are found breeding along the Gulf coast and Florida.

The heron family is as widely distributed as is that of the stork. The many species are characterized by their thin bodies and necks, straight narrow beaks, large blunt wings, and long legs. Most species, especially the egrets, have elongated plumes growing from the head, neck, back, and breast. Unlike storks and cranes, herons fly with their necks curved back between the shoulders. Although solitary in their feeding habits, they nest and roost in flocks. A hundred or more birds often frequent a single nesting site or heronry. Their nests are crude platforms of sticks placed in trees or sometimes on the ground. The young are born covered with down and are reared in the nest.

The great blue heron, one of the largest of American herons, is about 45 inches in length. Its plumage is slaty blue on the back, wing-coverts, and tail, with black and white streaked underparts. A long black crest grows from the back of its head. (For illustration in colors, *see* Birds.)

This bird is a great fisher. He stands statue-like in the water, until his keen eyes discover a fish coming toward him. Then, at exactly the right instant, with one sudden stroke of the bill he seizes the fish. Sometimes he



This stately Sandhill Crane, a wary creature still common in some parts of the United States, has brownish-gray plumage except for the reddish bare skin on its head.

THE TRAGEDY OF THE EGRETS—A SACRIFICE TO FASHION

stalks slowly through the shallow water, lifting up each foot so cautiously that scarcely a ripple warns the fish or frog he is seeking. The great blue heron ranges throughout the United States.

The little green heron is common in the eastern United States. This species is only 17 inches long. It has a black crown, reddish-brown neck, green back and wings, and grayish underparts. Unlike most herons, it is a solitary bird.

The great white heron, about 50 inches in length, has pure white plumage. It frequents southern Florida in colonies, placing its crude nest of sticks in the mangroves. Other common herons in the United States are the Louisiana heron, little blue heron, and the black-crowned and yellow-crowned night herons.

These pictures show the shameful way in which Egret families were sacrificed when plume hunters came along to secure aigrettes for the millinery trade. 1. Mother Egret keeping the newly hatched fledglings warm. 2. The mother bird shot by a plume hunter! 3. Baby Egrets crying for food. 4. The orphaned fledglings dying from hunger. Such scenes as these are now rare.

The most gorgeous birds of the heron family (*Ardeidae*) are the egrets, represented in the United States by three species. The American egret breeds in Oregon and California, and from Arkansas, Tennessee, North Carolina, Florida, and the Gulf coast south to Patagonia. During the nesting season this white bird wears a magnificent train of about 50 straight "aigrette" plumes that grow from between the shoulder-blades (*interscapular*) and reach beyond the tail. Even more gorgeous is the nuptial dress donned by the snowy egret, which breeds in the United States along the coast from North Carolina to Louisiana and Texas. The beauty of its white plumage is enhanced during the breeding season by long recurved interscapular plumes. The rare reddish egret breeds along the Gulf coast.

To the egrets beauty proved a curse, for women demanded their delicate aigrettes for adornment. The plumes develop early in the season, but, lest the killing of one bird rout the entire colony, the plume hunters waited until the eggs were hatched; then the adult birds were slaughtered, leaving the orphaned fledglings to starve. These lovely birds, once found by the tens of thousands, are now rare; only the efforts of the Audubon societies in securing and enforcing protective laws have prevented their complete extermination.

The cranes are not close relatives of the storks and herons, but form a separate order (*Gruiformes*) with the rails, gallinules, and coots. Of the 18 known species, two are North American. These large birds frequent marshes and plains, feeding on frogs, reptiles, field mice, and vegetable foods. They nest on the ground, laying two eggs. The young leave the nest soon after hatching. The crane's loud trumpeting call is due to the development of the trachea (windpipe), which is very long and coiled. The whooping crane, 50 inches in length, is the largest of the North American species. This white bird is almost extinct. It breeds in southern Mackenzie and northern Saskatchewan and winters in the Gulf states. The sandhill crane, a brownish-gray bird about 45 inches long, breeds from northeastern California, Wisconsin, and Michigan to southern Canada, but is rare east of the Mississippi except in Florida, where many are found. A smaller subspecies, the little brown crane, breeds from Hudson Bay to Alaska and winters in Texas and Mexico. (For description of the courting antics of the cranes, *see* Birds.)

The European crane (*Megalornis grus*), a grayish-colored bird, is the common crane in Europe. The crowned crane of Africa is so called because it wears a spreading tuft of feathers on the back of its head.

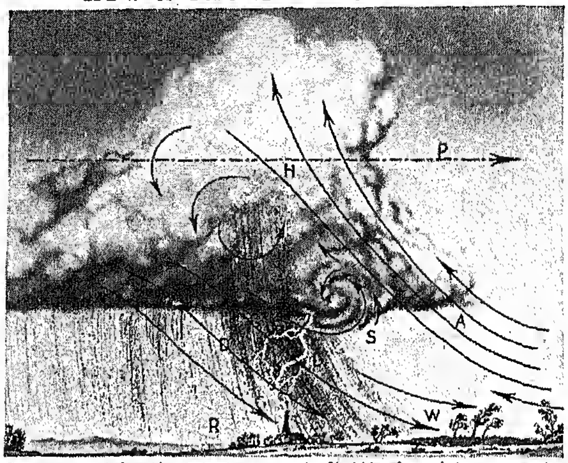
Scientific name of white stork, *Ciconia alba;* wood ibis, *Mycteria americana;* great blue heron, *Ardea herodias;* American egret, *Casmerodius albus egretta;* snowy egret, *Egretta thula;* little brown crane, *Grus canadensis canadensis;* sandhill crane, *Grus canadensis tabida.*

STORMS. A storm, we might say, is nothing but unusually violent weather. High winds are a conspicuous feature of most storms. When the wind rises over 40 miles an hour, we call it a *gale*. A storm with wind over 75 miles an hour is called by the West Indian name, *hurricane.*

In the Philippines such a storm is known as a *baguio*, and in Chinese waters, a *typhoon*. The sailor-novelist, Joseph Conrad, gives a vivid account of such a storm in his great story 'Typhoon'. Among the signs which foretell hurricanes is a dull red sunset caused by a thin haze of clouds; hot sticky air; an unexpectedly high barometer, with a dying down of the wind; and, if at sea, a growing swell. Then, suddenly, the barometer drops again; a rain cloud rushes forward from the horizon; and a deluge seems to fill the air with water, while the wind blows with hurricane force.

These hurricanes are intense cyclonic storms, with winds blowing toward a central region of low atmospheric pressure (*see* Weather). The winds blow spirally, instead of straight toward the center, because they are deflected by the rotation of the earth, counterclockwise in the northern hemisphere and clockwise in the southern (*see* Winds). These directions often are stated as a rule called "the law of storms." Sailing ship captains can avoid the dangerous central region of low pressure by taking the wind from the starboard, or right, in the northern hemisphere, and from the left in the southern. The ship then sails toward calmer weather at the edge of the storm. Sometimes a ship passes through a storm into an area where all seems calm and serene, and then runs into the storm again. The deceptive calm was the center, or "eye," of the storm.

HOW A THUNDERCLOUD ACTS



Strong local heating starts an updraft (A) of moist, warm air, and an accompanying downdraft (D) of cool air. The incoming moisture condenses into a cumulus cloud, which changes to a nimbus, or rain cloud, as the moisture condenses further into raindrops. Between the two drafts is a roll acud (S), where rain drops are churned about. This churning generates electric charges. Drops that are carried around aeveral times within the cloud may freeze to hail (H). When the cloud is sufficiently charged with water and electricity, rainfall (R) and lightning (L) begin. At the approach of the storm, we first feel the updraft, blowing against the prevailing wind (P), which carries the storm along. Then the downdraft strikes ua aa a strong gust (W), and the rain follows immediately.

Havoc Wrought by Tropical Cyclones

Tropical cyclones do terrific damage to shipping, crops, trees, and buildings. They cause waves which sometimes flood cities with great loss of life, as at Galveston, Tex., in 1900. When such storms arise in the West Indies, they start west with the trade winds; but, like all great air movements in the northern hemisphere, they are deflected to their right. Therefore they curve up across the Gulf of Mexico, turning eastward or northeastward into the Atlantic.

The power required to keep such a storm going probably comes from the heat which is released when moisture is condensed to rain within the storm. This heat keeps the air pressure low at the center of the storm, and, as long as the central low persists, the storm continues. A typical hurricane may generate over 100 billion horse-power. The Miami hurricane of 1926 generated power enough to run every dynamo, motor, and steam engine on earth for 20 years.

Thunderstorms

Thunderstorms commonly occur late in hot afternoons. They are brought on by a vertical whirl of air, as shown in the accompanying diagram. Even though such storms are mere local disturbances, the power represented by them is tremendous. A one-inch rain over 10 square miles requires 232,300,000 cubic feet of water. To evaporate and condense this water at 50° F. during the lifetime of the storm takes more than 36 million horsepower—a fact which dooms to failure all efforts to "make rain."

In the tropics, thundershowers may occur 200 days a year. New Orleans may have 70 such days in a year, while Boston may have as few as 16. The British Air Ministry estimates that some 1,800 such storms are in progress somewhere at any given moment.

Tornadoes

Tornadoes, or miscalled cyclones, arise when the conditions that cause thunderstorms are unusually violent. The Great Plains of North America, including the "cyclone state" of Kansas, are tornado areas because here, along the edge of the Rockies, winds tend to blow southward, while they tend to blow northward farther east. These contrary motions start violent whirls around local updrafts, thus causing tornadoes.

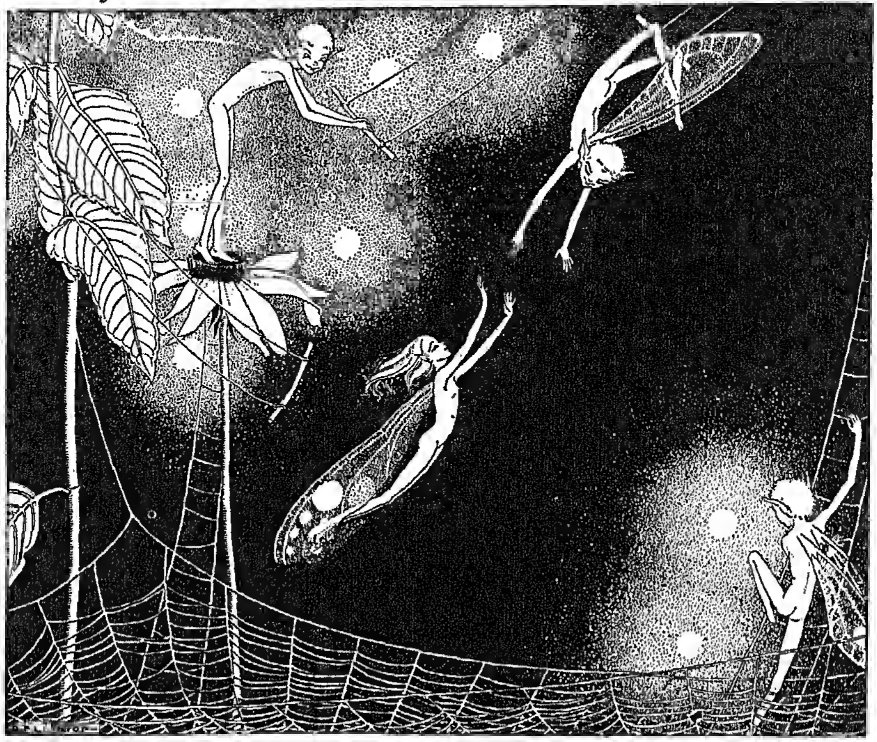
By centrifugal action, the air is thrown away from the center of the whirl, thus leaving a core of low pressure—perhaps only 1/10th of normal. Because of the suction in this low-pressure core, houses collapse and roofs are carried off; corks are drawn from bottles, and window panes explode outward. Around the edge of the whirl, the wind may blow 200 miles an hour. The whole world seems one great roar, as the storm moves eastward at 25 to 40 miles an hour. Fortunately a tornado is only a few thousand feet wide.

A *waterspout* is a tornado at sea, sucking in water at its base, and carrying the water spirally upward with the wind to feed the overhanging cloud.

A NEBRASKA TORNADO CAUGHT IN ACTION

Noting an unusual storm approaching, a photographer in David City had his camera ready and was rewarded with this perfect picture of the funnel-shaped tornado, or "twister," which swept over his town causing much damage. Notice how the bottom of the funnel is above the ground, rather than touching it. This tip will be above tree tops at times, and an instant later will touch the ground. Like other states of the Great Plains region, Nebraska is often visited by such storms.

The ART *of* STORY-TELLING *and the* STORY-TELLERS



Ever since the circus started, the spiders had been spinning a net under the trapezes which swung from the loftiest flower stalks. They had spun the trapezes, too, and the ladders which ran up to the flower tops. Back and forth they had gone over the arena, not a bit disturbed by the din in the circus below, spinning until a great net spread high above the rings. It was so high that if even those giants, the turtles, had stood on their hind legs—not on the moss, but on their toadstools—and stretched up their necks—and it is surprising how far out of its shell a turtle's neck can stretch—the net would have been as high again above their goggling eyes. It was so high that when the fairies threw back their heads to watch the fairy acrobats who were already climbing the cobweb ladders, there were stars in the net.—From 'The Fairy Circus', by Dorothy P. Lathrop (Macmillan).

STORY-TELLING. The art of story-telling is as old and as spontaneous as dancing and singing. As soon as man began to travel he carried with him the songs and tales he knew, and the story of their passing from India through Persia and Arabia to the civilized countries of Europe is one of the most fascinating records in human progress as it is in the history of literature.

> Whoever learns the book by heart,
> Or through the story-teller's art becomes acquainted,
> His life by sad defeat—although
> The King of Heaven be his foe—
> Is never tainted.—*The Panchatantra*

Stories are as sensitive to climate, soil, and cherishing care as plants and animals and human beings are. There are stories which cannot be transplanted from the countries in which they originated, and for enjoyment of them we must rely upon the story-teller's magic to transport us in imagination to those countries.

There are stories which readily take root and flourish all over the world with variations characteristic of the countries in which they are found. Collecting stories which belong to different countries is as fascinating a hobby as collecting postage stamps, provided one has had early and familiar acquaintance with story literature in versions which have been taken from the lips of native story-tellers.

The selection of picture story-books and song-books for the first three divisions of the list accompanying the article Libraries has been made with a view to providing the elements of story literature. Song and dance, story and picture belong together in early childhood of the present day even as in the childhood of the race. Now as then, stories may be sung as well as told in the firelight in the open or at home. There are families in which mothers and fathers, grandmothers and grandfathers have been accustomed for generations to share their store of old rhymes and ballads, singing games, nonsense verses, and rhythmic tales. And when, as sometimes still may happen, the story-teller is accompanied by the harp, or by the guitar, the ancient art takes on new meaning in the life of a family or a community which has grown accustomed to look upon story-telling as a method of teaching rather than as an art in itself.

Of incomparable value to any system of teaching, the story must remain forever free of didactic application. In the East, while regarded for centuries as the touchstone for a whole system of ethics, the story has

never lost its appeal as drama—drama in which the actors are usually animals with human characteristics. A recent popular translation of 'The Panchatantra' (The Five Books) from the Sanskrit reveals to the general reader as well as to the scholar the wit and wisdom of stories and epigrammatic verses recorded more than 2,000 years ago "to set forth the wise conduct of life."

'The Panchatantra' contains the most widely known stories in the world, gathered under five heads —The Loss of Friends, The Winning of Friends, Crows and Owls, Loss of Gains, Ill-Considered Action. Arthur Ryder, who has made this delightful translation, speaks of it as one of La Fontaine's important sources. The collector of stories will find in it many a familiar tale, and the parent who is seeking wise guidance in establishing social relationships will take from it many suggestions as applicable to the wise conduct of life in the present day as in the year 200 B.C. Many of the stories contained in 'The Panchatantra' lie quite outside the experience and imaginative interest of children, and this is also true of the Bible, 'The Arabian Nights', and all great source books of stories not originally intended for children.

Quality of the Wording Important

The wise story-teller will choose only those stories which he feels reasonably certain he can bring to life by his own power to recreate. Mary Gould Davis, who includes the story of 'Numskull and the Rabbit' in a collection of stories she has told to many groups of children, says: "That the wit and wisdom of these old tales strike home to the minds of boys and girls is proven by their faces when the story is told that is given here in this book. It is not only the action and characters that appeal to them. It is the words themselves. The wording of these stories, in Mr. Ryder's translation, is a vital part of them."

Miss Davis, whose experience as a story-teller has led her to comparative study of folk-literature, has herself translated a selection of stories from the Italian in words so well suited to the tales as to suggest that the translator has heard them told in their own country. It is by this quality of spoken language that the best version for the story-teller's use is determined. The language in which a story is told is as important as the subject matter. It must belong unmistakably to the tale to be told rather than the book to be read. Book language does not stick in the memory nor does it make "the happening" seem real. At no period in life is one so sensitive to the sound of words or so susceptible to the picture-making possibilities of words as in early childhood, when every child is a potential story-teller and language itself a thrilling adventure.

A Story-Teller of Ireland

In 'The Fountain of Youth', Padraic Colum has pictured the story-teller of his own youth telling his stories by the light of a peat fire in a language that had not been written down. "He had words," says this Irish poet and student of the myths and legends of many lands, "that had not been made colorless by constant use in books and newspapers. He was free to make all sorts of rhymes and chimes in the language he used." Out of golden memories of tales thus heard in childhood, to the rendering of which he brought the full power of his racial imagination, Padraic Colum first told to children in another land, before writing them down, his stories of 'The King of Ireland's Son'. "I never see the printed page in reading my own stories or poems," says Mr. Colum; "literature first came to me orally."

The Gammer Grethel, whose accurate memory and genius for story-telling provided the Brothers Grimm with so many of their well-known fairy tales, must have possessed intuitive understanding of the value of words in the preservation of a tale, for philologists though the Grimms were, they wrote down the stories she told them in her words rather than their own. The publication of the first translation of these stories into English and the illustration of them by Cruikshank (1823) may be regarded as a landmark in preparing the way for a revival of story-telling as an art, of which Hans Christian Andersen was to become the moving spirit in the 19th century and the inspiration for a wider application of it in the 20th century.

Andersen not only delighted children with the stories he remembered hearing as a child, but with many others of his own invention. He carried the story personally back into the courts of Europe and charmed kings and queens and emperors with fresh tales of the follies of royalty. Andersen took the story into the theater, which had rejected him as an actor, revealing it as drama in miniature with all the world for its stage. And it was Andersen who demonstrated to story writers and story-tellers from his day to ours that stories for children may be spun out of anything under the sun or the moon, provided the conception of the story-teller is equal to the dramatic requirements of his art. When the curtain goes up on the story, the story must be there as surely as the play. It is impossible to estimate the value of Andersen's contribution to story literature and to the art of story-telling. To him more than to any other personality may be attributed the release of the play spirit in literature which has characterized the best original writing and the best retelling of stories for the past hundred years. Andersen revealed one of the primal needs of childhood, that of investing the inanimate with life.

Famous Names in the Art

Contemporaneously with the creation of a new imaginative story literature for children by Lewis Carroll, George Macdonald, Rudyard Kipling, and Frank Stockton, there appeared new collections, fresh translations, and vigorous retellings of folk-tales, myths, legends, and epic tales designed for boys and girls whose appetite for stories does not diminish if well fed, but requires stronger meat in the years just preceding the teens. Thanks to Asbjörnsen and R. B. Andersen in Norway, to Sir George Dasent, Andrew Lang, and Joseph Jacobs in England, to Douglas

Hyde, William Butler Yeats, and Lady Gregory in Ireland, to Hawthorne, Sidney Lanier, Horace E. Scudder, Frank Cushing, George Bird Grinnell, Howard Pyle, and Joel Chandler Harris in the United States, English-speaking children were fairly well provided with good story-books by the end of the 19th century. But far too many of these books remained undiscovered by boys and girls who had acquired the mechanics of reading, but not the love of it.

The 20th century brought many changes, and none more prophetic of a new day than the revival of Old World dances in city streets and parks and community houses of the New. The great out-of-doors movement, with its games and sports for everybody, its camp fire, and the woodland ritual derived from native Indian lore for boys and girls, was under way. The fairy tale had come back into the theater with 'Peter Pan', and a fresh wave of interest in the drama and in children's plays was sweeping over the country. "The play's the thing" was being incorporated into educational doctrine.

The tide of immigration which continued to flow through the United States from countries of the Old World was bringing living streams of story and song to enrich and enliven educational methods and social relationships. But not until language barriers were set aside by kindergarten, social settlement, civic playground, and public library was this fine inheritance of vitalizing literature made available for children of many races who were expected to grow up in a new country with a love of its language and regard for its traditions. The practise of story-telling as a means to this end, without loss of spontaneous joy in the story, has not been confined to any one institution or locality. The idea apparently presented itself simultaneously to a number of people in different parts of the country, and met with enthusiastic response.

The children's department of the public library, then in its infancy, provided a logical center for story-telling, since it was organized not merely to serve as a repository for the literature which belongs to childhood and youth, but to interpret and evaluate that literature to the community.

The Carnegie Library of Pittsburgh was the first library in the country to establish a weekly story hour for children, and after some experimentation, to accord it a high place as a method of guidance of children's reading. Its printed lists and programs of stories have been widely used by schools as well as by public libraries and story-tellers.

Marie Shedlock's Influence

Story-telling was already in the air when Marie L. Shedlock, a professional story-teller, well known in educational and dramatic circles in England, first came to America to give French monologues and tell Andersen's fairy tales to children and to grown people. The response to her art and to her inimitable interpretations of the poetry and philosophy, the wit and humor of Andersen was immediate. From Boston to San Francisco, and from Montreal and Toronto to St. Louis, the stories she told and the way she told them are still remembered. Miss Shedlock returned to tell stories, and to give instruction in the art of story-telling to students in training to become children's librarians and teachers until she was recalled by the London County Council in 1907 to take back to the teachers of England the inspirational value of her story-telling experience in America. She is probably the only woman who has ever told stories at Rugby and other boys' schools in England. In 1915 Miss Shedlock was recalled to America by a committee of representative women in New York and remained to tell stories throughout the period of the war. To the inspiration of this gifted story-teller the public libraries of New York and of Boston owe the establishment of story-telling hours, which have not only extended the range and improved the quality of reading done by foreign-born and native American boys and girls, but have been accorded a definite place in the life of those cities for a period of 25 years.

A report published by the Playground Association of America in 1910 gives a fair picture of the extent to which story-telling was then being carried on in playgrounds, public libraries, social settlements, and such other institutions as came under the notice of a committee representing all sections of the country and its leading citizens as well as those directly concerned with the development of story-telling. This report, now available only in the files of *The Playground* (June 1910), remains the only generalized consideration of the subject from the standpoint of broad civic application and constructive development. Its basic suggestions on story-telling, derived from varied personal experience, are as usable by story-tellers today as when presented in Rochester, N. Y., with a memorable accompaniment of an Irish tale told by Seumas MacManus and a 'Just So Story' told by Anna Cogswell Tyler, then supervisor of story-telling in the New York Public Library.

The Future of Story-Telling

Since the prediction of Mrs. Gudrun Thorne-Thomsen regarding the future of story-telling is borne out by results over a period of 20 years, her words are quoted here: "As to the future of the movement, I believe its purposes are best served by the story-teller being an integral member of the organization she serves. I believe that if the organizations which express themselves so sympathetic toward the work would coöperate and give definite instruction to their workers and also give them a fair amount of supervision and direction, the whole movement might be placed on a dignified and wholesome basis."

Mrs. Thorne-Thomsen, who is a teacher of literature and a story-teller of great power in the field of her own inheritance, Scandinavian literature, was at that time assisting in a unique civic experiment. She was telling stories to children in the field houses of the public recreation centers of Chicago as part of a coöperative movement supported financially by private organizations. The Chicago Public Library,

then just beginning to develop its system of branches, took an active part in this experiment. Mrs. Thorne-Thomsen's instruction in the art of story-telling at the Cleveland Public Library and at the Carnegie Library of Pittsburgh was the inspiration for years of students who in time became story-tellers for those cities and for other communities.

Nor has story-telling been confined to cities. Sara Cone Bryant, Ruth Sawyer Durand and Edna Lyman Scott, Richard T. Wyche, and others have carried the story hour to many rural communities north, south, east, and west. Fortunately they have recorded in books, which are equally suggestive to story-tellers and parents, some of the results of their experience.

Books About Story-Telling

The Art of the Story-Teller. By Marie L. Shedlock. (Appleton.) The clearest and most readable exposition of the subject as an art. The answers to questions asked by teachers will interest all parents. Contains also a bibliography and the text of 18 stories.

Way of the Storyteller. By Ruth Sawyer Durand. (Viking.) This book combines the philosophy and the rich experience of one of the best of modern story-tellers. Eleven of the author's favorite stories are included, and there is an excellent bibliography.

How to Tell Stories to Children. By Sara Cone Bryant. (Houghton.) A suggestive book for the teacher or for the mother inexperienced in telling stories to little children.

Children's Stories and How to Tell Them. By Woutrina A. Bone. (Harcourt.) An informing book for the story-teller who is a student of the art and of source material. Contains a valuable bibliography of original sources.

Selected Lists of Stories

Stories to Tell to Children. (The Carnegie Library of Pittsburgh.)

Stories; A List of Stories to Tell and to Read Aloud. By Mary Gould Davis and Joan Vatsok. (New York Public Library.)

Stories to Tell. (Enoch Pratt Free Library, Baltimore.)

The Horn Book: Story-Telling Number. Edited by Bertha Mahony. May 1934. (The Horn Book, Boston.) Contains portraits, a biographical sketch of Marie L. Shedlock, and articles on story-telling.

Books of Stories

Twenty-Four Unusual Stories. Selected and edited by Anna Cogswell Tyler. (Harcourt.) Includes stories by Quiller-Couch and others chosen for their appeal to older boys and girls.

This Way to Christmas. By Ruth Sawyer. (Harper.) This book contains 'The Voyage of the Wee Red Cap', a favorite Christmas story, which Ruth Sawyer brought home from Ireland to her own little boy.

A Baker's Dozen. Selected by Mary Gould Davis. (Harcourt.) Thirteen favorite stories of boys and girls with an introductory chapter for the story-teller.

Stories and Tales. By Hans Christian Andersen. (Houghton.) This book contains valuable notes on the stories by Andersen. A companion volume, 'Wonder Stories Told for Children', includes more of the better known stories.

The Book of Fables and Folk Stories. By Horace E. Scudder. (Houghton.) A standard collection for story-telling or reading aloud.

Tales of Laughter. Selected by Kate Douglas Wiggin and Nora A. Smith. (Doubleday.) Includes a varied selection of more than a hundred folk and fairy tales chosen for their humor and value as literature.

The Book of Elves and Fairies. By Frances Jenkins Olcott. (Houghton.) Fairy-lore of China, Japan, Sweden, Scotland, and other countries. Contains a subject index classifying the stories for the ethical significance.

Told Under the Green Umbrella; Old Stories for New Children. Selected by the Literature Committee of the International Kindergarten Union. (Macmillan.)

The Fountain of Youth. By Padraic Colum. (Macmillan.) A collection of stories to be told selected by Mr. Colum from his own books, with a suggestive chapter on story-telling.

Ting-a-Ling Tales. By Frank R. Stockton. Illustrated by E. B. Bensell. (Scribner.) This collection of tales, dedicated to the "memory of all Good Giants, Dwarfs and Fairies" by a novelist whose humor and whimsy have become a part of American literature, is a book to share, either by reading aloud or by story-telling. 'The Poor Count's Christmas' (Stokes) is one of the jolliest and most festive of Stockton's tales for the Christmas season. 'The Queen's Museum and Other Fanciful Tales' (Scribner) contains 'The Griffin and the Minor Canon', a story that is a delight to grown-ups as well as to children, and that amusing and unique tale which belongs to the springtime—'Old Pipes and the Dryad'.

A Street of Little Shops. By Margery Williams Bianco. Illustrated by Grace Paull. (Doubleday.) Gay and original stories of village life. 'The Baker's Daughter' is a prime favorite.

Island Nights' Entertainments. By Robert Louis Stevenson. (Scribner.) Contains 'The Bottle Imp', a dramatic mystery story, a suggestion of which is conveyed by these lines: "And he opened a lockfast place, and took out a round-bellied bottle with a long neck; the glass of it was white like milk, with changing rainbow colors in the grain. Withinsides something obscurely moved, like a shadow and a fire."

The Day's Work. By Rudyard Kipling. (Doubleday.) Contains '007', one of the best of railroad stories, in which a new locomotive tells the story of his first experience at a wreck, how he was tested and found worthy to be "a full and accepted Brother of the Amalgamated Brotherhood of Locomotives."

New Arabian Nights. By Robert Louis Stevenson. (Scribner.) 'The Sire de Maletroit's Door' is a favorite story with both boys and girls, the former eagerly following the adventure, the latter enjoying the romance.

The Starlight Wonder Book. By Henry Beston. (Little.) Contains 'The Brave Grenadier' and an amusing story called 'The Enchanted Baby'.

Tales from Silver Lands. By Charles J. Finger. Illustrated by Paul Honoré. (Doubleday.) Contains 'The Hungry Old Witch', a good story for Hallowe'en, and 'The Tale of the Lazy People'. Mr. Finger first heard these stories told by South American Indians and retold them for his children.

Children of the Dawn. By E. F. Buckley. (Stokes.) Contains 'The Winning of Atalanta' and 'The Curse of Echo' among Greek classical tales. Beautifully told and favorite stories with older girls.

Round the Fire Stories. By Conan Doyle. (Murray.) Contains 'The Brown Hand', a good story with a ghostly element, and also other mystery stories for older boys.

Once in France. By Marguerite Clément. (Doubleday.) Historical and romantic tales of old France.

The Wonder Clock. By Howard Pyle. (Harper.) Twenty-four stories recreated from folk-literature by a born story-teller. Pyle's renderings of the Robin Hood and the King Arthur stories are also admirable for telling or reading aloud.

The Gold Bug, and Other Tales and Poems. By Edgar Allan Poe. Selected by Elva S. Smith. (Macmillan.) This well-chosen collection by an authority on literature for children and young people is a reminder to story-tellers to associate poems with the tales they tell.

The Bold Dragoon and Other Ghostly Tales. By Washington Irving. Edited by A. C. Moore. (Knopf.) Good stories for big boys to tell at Hallowe'en or round the camp fire.

The Firelight Fairy Book. By Henry Beston. (Little.) Modern wonder tales which have the spirit of adventure. 'The City Under the Sea' was composed in a submarine off the Irish coast during the World War.

Lion, mighty king of the beasts, as drawn by Vladimir Lebedev in his 'The Lion and the Ox' (Macmillan), a picture-book version of part of the wise 'Panchatantra'. Most of the actors in these tales are animals with human characteristics.

Following the Folk-Tales Around the World

FOLLOWING the path of the folk-tales is a stimulating adventure. It takes us through the different countries in space, and through the centuries in time. It has the same thrill that explorers must feel when they set out to find new lands. It brings knowledge, too, just as surely as knowledge came to the old discoverers when they charted unknown seas. It also brings an understanding of men's motives and a tolerance that recognizes faith where ignorance would see only superstition.

These old tales, told and retold by the human voice for centuries before they were printed, grow up out of the life of a country as a tree grows up out of its soil. And as a tree is shaped by the sun and the wind, the heat and the cold, the drouth and the rain, so the stories are influenced by the thoughts and the actions, the aspirations and the fears, of a people. Often the outline of a tale, and sometimes even the characters, will be common to more than one country. But always the land itself and the people who dwell there leave a deep impression on the story. It is as though they had dressed its skeleton in their own clothing and so made it their own.

It would be hard to find a better antidote for the troubles that beset our modern world than the folk-tales. Their humor, their freshness, their clear, objective action, their logical distinction between good and evil, between right and wrong, are as refreshing to us in our present perplexing situations as the shade of a green tree is refreshing to a traveler who has stumbled on for hours under a blazing sun.

The clearness of their construction makes another exhilarating contrast to our modern literature. Take, for instance, the old Norse story of 'The Three Billy Goats Gruff'. In the very first paragraph we have met the characters, even named them, for we are told that "the names of all three were Gruff"; we have learned the country, for only Norway or Scotland would call a brook a "burn" and of the two only Norway has trolls; and we have discovered the motive and the "opposing force." Then we get the action in a series of three incidents: first trial, second trial, and success. Then the tale ends, as all folk-tales end, simply and most satisfactorily—in this case with the cryptic remark:

So, snip, snap, snout,
My tale's told out!

Children turn to them instinctively, because they waste no time. Right at the start they give you the place, the characters, the action, humor, and concrete ideas.

India and 'The Panchatantra'

Many, if not all, of the tales must have come originally from the cradle of civilization, the East. One of the oldest and most widely known of the folk-collections is the Sanskrit book called 'The Panchatantra', which has been discussed in the earlier part of this article. In Arthur Ryder's translation, this book seems to have something for every age, from seven to seventy. There is one picture-book, so far as we know, derived from it—a translation through the Arabic of a part of the First Book, called 'The Lion and the Ox', with strong black and white drawings by a Russian illustrator, Vladimir Lebedev.

In India we find another important group of tales—the stories of the rebirth of the Buddha. Their most effective retelling is in Marie L. Shedlock's 'Eastern Stories and Legends', because Miss Shedlock manages to convey by her wording the *reason* for their telling—the fact that they are the outward expression of the faith of a people. She is far too wise and too sensitive to point the moral. Yet in each tale you feel the lesson which a great teacher is giving to his followers. One detail of her wording is especially revealing. Instead of beginning the story with the conventional "Once upon a time," she begins it with the words that the priests in the temple use: "And it came to pass that the Buddha was born again as . . ."—whatever animal that particular incarnation depicts. This puzzles the children a little. But to

certain children that perplexity is but the beginning of later understanding. In her 'Jataka Tales' Miss Babbitt tells the same stories, as the common people tell them to one another, humorously and objectively, with no attempt at interpretation.

Another group of interesting Indian folk-tales is in Flora Annie Steel's 'Tales of the Punjab'. These too are from the common people. One can imagine them being handed on from group to group, from village to village. They are amusing and rather exciting, and obviously very old. Two favorites with modern boys and girls are 'Lambikin' and 'The Bear's Bad Bargain'. The book is illustrated with fascinating small drawings by Lockwood Kipling. In her 'Fairy Tales from India', Katharine Pyle has retold some of the tales that were included in a book now out of print, 'Old Deccan Days', by M. E. Frere. The story of 'The Jackal, the Barber and the Brahmin Who Had Seven Daughters' is particularly good to tell or read aloud.

Persia and Arabia

From Persia comes a cycle of hero stories that is outstanding. It is called 'The Shah Nameh', and was written first by the Persian poet Firdusi. In her fine translation Helen Zimmern calls it 'The Epic of Kings'. The most appealing and dramatic figure in it is probably Rustam. The story of his birth, the love story of his father and mother—Zal and Rudabeh—is one of the great romances of literature. Boys are fascinated by the scene where Zal's right to his inheritance is tested through the riddles that the judges ask him. Rustam's courage and skill as a warrior, his dignity and the justice of his stormy rule, make him a hero who will always appeal to men. Rustam's story has also been told in Alan Chidsey's 'Rustam, Lion of Persia'. A book that gives the Persian heroes in simpler language is 'The Ivory Throne of Persia' by Dorothy Coit.

In Arabia the hero story is told in 'The Romance of Antar' by Eunice Tietjens. Antar was a great poet, a great warrior, and a great lover. He sang as he rode into battle, and the songs surging up through his immense vitality were remembered by loyal followers. It was said of him by some old chronicler that "he was like no other child born of the desert, like a fragment of a thunder cloud." 'The Arabian Nights Entertainment' is too well known to need any comment here. No woman, and perhaps no man, can grudge Scheherazade her victory over the Sultan and his decree of death! In Constance Smedley's 'Tales from Timbuktu' we have stories told to an audience in the market place—strange, exotic tales with a distinctly Eastern flavor. The one called 'The Stone Lion' is from Tibet, and we will let that take us along the path that leads toward Mongolia and the Himalayas.

Toward China and Japan

In Mongolia there is a curious and interesting hero story called 'Gessar Khan'. Like so many of the hero stories, it shows first the *need* of a hero. Buddha himself decides where and how this hero shall be born. Then the tale of his deeds develops in stately, dramatic prose. The book has been admirably translated by Ida Zeitlin and illustrated by the Russian artist Theodore Nadejen.

From high up in the Himalayas comes a group of tales that appeal strongly to boys and girls—perhaps because they are so different. The book is called 'The Magic Bird of Chomo-Lung-Ma' and is by Sybille Noel. One of the stories is a variant of a witch tale that is found in so many countries. In Ireland it is called 'The Old Hag's Long Leather Bag', in Norway 'Buttercup', in England either 'The Old Witch' or 'Mr. Miacca'. Here it is called 'Apple-Tree Witch', and it is by far the strongest and the most dramatic of them all. No one of these stories has the directness of other folk-tales. They depend largely upon their strange wording and background. In 'Apple-Tree Witch', for instance, there is a long time before the witch herself appears in the story. But during that time we are held by the word pictures and by an atmosphere that is as strange and as remote as the top of the great mountain. "Chomo-Lung-Ma" whence they come. The fact that the tales actually are from Mount Everest, the "unconquered mountain," interests boys and girls.

The lion learns from his messenger, the jackal, that a rival is challenging his kingship. From 'The Lion and the Ox', illustrated by Vladimir Lebedev. (Macmillan.)

Very little of the Chinese folk-lore has been brought into form for the general reader. Padraic Colum says of it: "Their universe has been created and is sustained by *impersonal* forces; that which makes a

mythology is not conceived by them." In 'Myths and Legends of China', E. T. C. Werner has presented the basic stories, but not in a way that would especially attract young people. As a "background" book for story-tellers and lovers of folk-lore it has value. A young American, Arthur Chrisman, heard an old Chinese tell some of the tales current among the common people and put them into a book called 'Shen of the Sea'. In words that are somehow quaint and formalized—"stylized" like the traditional Chinese drama—it gives some of the "origin" stories: the origin of tea, of dragons, of chopsticks. It is a particularly good book for Hallowe'en, because several of the tales have a ghostly quality. In 'Ah Tcha the Sleeper' there is a description of a black cat that is characteristic of the book: "The cat was black in color, black as a crow's wing dipped in pitch upon a night of inky darkness. That describes her coat. Her face was somewhat more black."

In Laurence Housman's 'Moonshine and Clover' there is a story called 'A Chinese Fairy Tale'. It tells of a famous painter who, as a child, is helped and encouraged by the spirit of one of the greatest of all Chinese artists. Delicately and without emphasis, it shows the boy's fanatical devotion to a form of art that is peculiarly Chinese.

From Japan come tales that are characteristic and amusing. One of the most interesting collections is 'Japanese Fairy Book' by Madame Y. T. Ozaki. It gives many of the animal fables, the "peasant" stories, and the famous harvest story called 'My Lord Bag of Rice'. The Japanese goblin, who looks in the daytime like a harmless old woman, thrills American boys and girls. The badger is the clever animal who outwits other animals, and even man. There is one story that is subtler than most folk-tales and has a special interest for older girls. It is called 'The Matsuyama Mirror' and it is told in both Madame Ozaki's book and in 'Green Willow' by Grace James. 'Green Willow' also has a variant of the familiar "rich brother and poor brother" tale, called 'The Mallet', and a romantic story called 'The Black Bowl', that must be to the girls of Japan what 'The Sleeping Beauty' is to European girls.

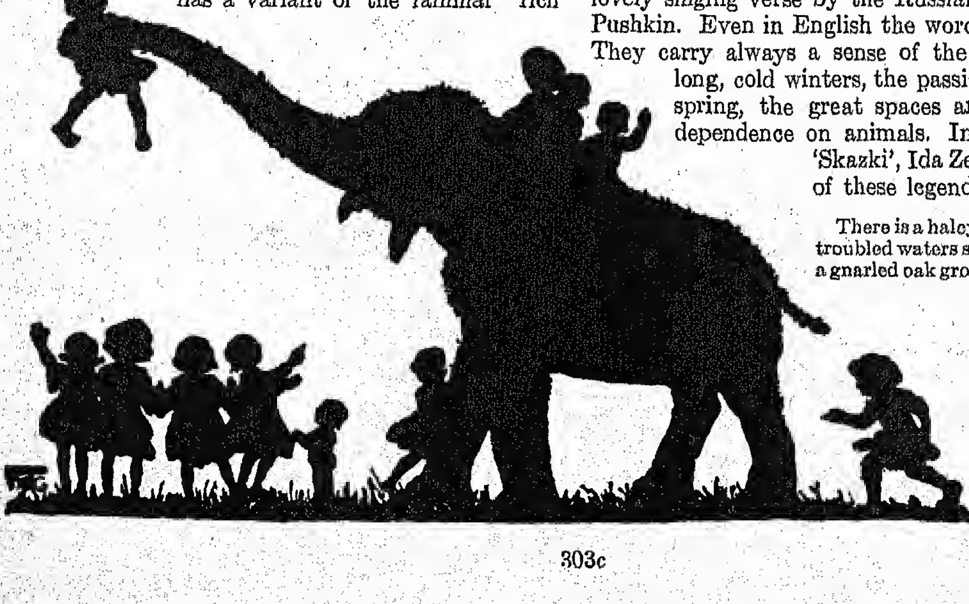
Perhaps the most authentic and beautiful translations have been made by Lafcadio Hearn. 'The Boy

Who Drew Cats' in his 'Japanese Fairy Tales' is a classic. Older boys and girls like 'Prince Bantam', the story of a hero who, like Zal in the Persian epic, was born to restore a line of heroes and to save his people. The book has one unique character—the giant Benkei. No one who has read the story of Benkei's theft of the great bell from the monastery can put the book down until his adventures are complete. It is illustrated with unusual drawings by Lynd Ward.

Over the Caucasus Into Europe

For the transition from East to West there is a group of tales from the Caucasus Mountains, told in lovely singing verse by the Russian poet Alexander Pushkin. Even in English the words are like music. They carry always a sense of the old Russia—the long, cold winters, the passionate welcome to spring, the great spaces and distances, the dependence on animals. In the prologue to 'Skazki', Ida Zeitlin's translation of these legends, we read:

> There is a halcyon sea, and from its troubled waters silver mists rise. And a gnarled oak grows on the shore, and



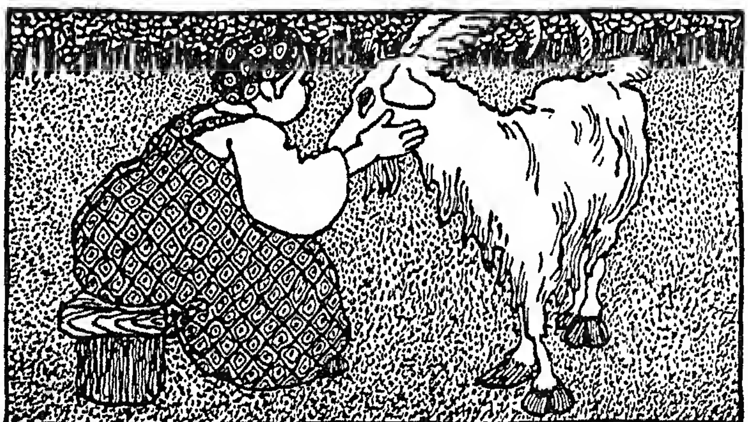
The elephant is portrayed as a friendly animal in Ellen C. Babbitt's 'Jataka Tales' and 'More Jataka Tales'. (Century.) The two drawings are by Ellsworth Young.

a learned cat that is chained with a chain of gold walks forward and back. And he sings as he goes to the right, and as he goes to the left he tells strange tales of enchantment.

Some of these Caucasus tales have been translated by Post Wheeler in his 'Russian Wonder Tales'. One of the favorites is the story of the 'Little Humpbacked Horse' who brings his master through many trials and adventures to a happy marriage with a Princess. It has been retold in an entirely different spirit by Peter Yershov in 'Humpy'. Post Wheeler's book is illustrated by Bilibin, and is a valuable record, in both text and pictures.

Ah Tcha encounters the black cat witch. This and the illustration at the right are by Else Hasselriis, in 'Shen of the Sea', by Arthur Chrisman. (Dutton.)

Russia has a large group of animal fables and of tales told by workers in the fields. Arthur Ransome retells them in his delightful 'Old Peter's Russian Tales', and Valery Carrick tells them for the younger children in a series of picture-books. Any volume of Carrick's 'Picture Tales from the Russian' is a wise choice for a child who is just learning to read. He illustrates them with simple, amusing line drawings. Boys and girls of almost any age like to chuckle over the Russian version of 'Johnny Cake' or 'The Gingerbread Man'. It is called 'The Bun', and instead of the "sowers and reapers" the little bun meets a rabbit, a wolf, and a bear. Chanting his song, he gets away from them all, only to fall at last into the greedy mouth of the sly fox.



"There was an old woman who had a gray goat." The simple text and delightful pictures of Valery Carrick's books win favor with all small children. This one is taken from 'Still More Russian Picture Tales'. (Stokes.)

In Marie Shedlock's 'The Art of the Story-Teller' there is a fascinating Russian folk-tale called 'To Your Good Health'. Even sedate grown-ups like to hear it told, and boys are all in sympathy with the shepherd who defies the Czar and wins his right to say "To Your Good Health" when and where he pleases.

From Russia we pass into Finland, the little country that may well boast of her epic story—one of the greatest of all hero tales—'The Kalevala'. It is so ancient that no one knows when it was first sung. It was not until the 19th century that Zacharias Topelius and Elias Lönnrot gathered it into a complete record. Later it was translated into English by John M. Crawford, in a meter like that of the original. Surely Longfellow took his meter for 'Hiawatha' from 'The Kalevala'. Contrast the two lullabies:

> Yonder is thy golden infant,
> There thy holy babe lies sleeping,
> Hidden to his belt in water,
> Hidden in the reeds and rushes.

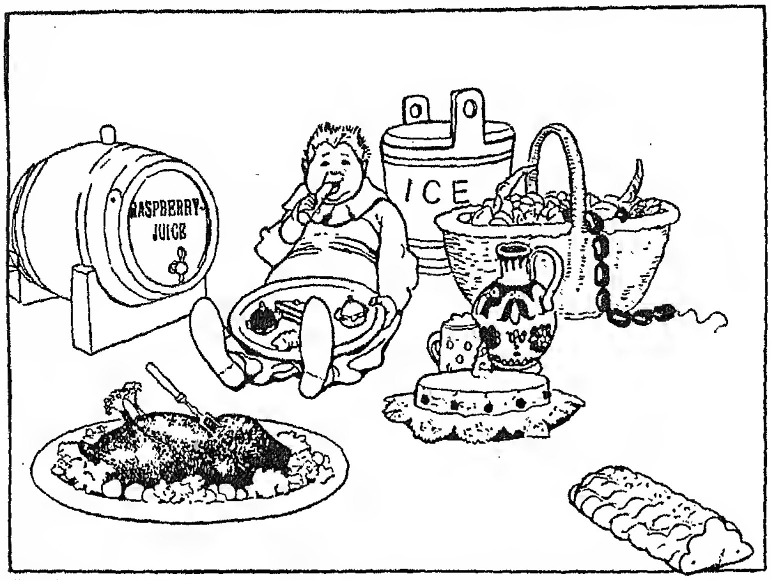
And from 'Hiawatha':

> There the wrinkled old Nokomis
> Nursed the little Hiawatha,
> Rocked him in his linden cradle,
> Bedded soft in moss and rushes . . .

The two heroes, Ilmarinen the Smith and Wainamoinen the Minstrel, are so individual, so abounding in courage and humor and vitality, that their actions leave one breathless. Their tumultuous wooing of the Maid of Beauty makes modern love stories seem but "milk and water" in comparison!

There is a prose retelling of 'The Kalevala' that boys and girls like, in a book called 'The Sampo' by James Baldwin. Parker Fillmore has told it, too, in his 'The Wizard of the North'. Parker Fillmore has also brought us the folk-tales from Finland. His 'Mighty Mikko' introduces us to Mikko the Fox, who reminds us of the French Reynard, Pecka the Wolf, and Osmo, the stupid but kindly Bear. Their amusing dialogue gives us a feeling for the Finnish peasant, who evidently loves to talk, and has a great admiration for the skilful bandying of words. This book is a favorite with almost all boys and girls.

The Czechs, for all their stormy history, have preserved a folk art and folk literature of which they may well be proud. One of the most charming examples of a "picture" story-book is the old Bohemian tale of 'The Cock and the Hen', with illustrations in color by Rudolf Mates. Parker Fillmore has collected the stories in several volumes. They are lively, humorous tales, with well defined plots and appealing characters. Little children particularly like the three stories in 'The Shoemaker's Apron'—'Budulinik',



Smolineck revels in the feast, not realizing that he himself is to be a dinner for the bad fairies. His story appears in 'The Disobedient Kids', by Bozena Nemcova. (Koci. Prague.) Illustrated by Artus Scheiner.

'Kuratko', and 'Smolicheek'. 'Smolicheek' is told again, though under the name 'Smolineek', in 'The Disobedient Kids' by Bozena Nemeova.

From Germany come folk-tales that are known all over the civilized world. They were taken down from all sorts of people, rich and poor, high and low, by Wilhelm and Jacob Grimm. It is great fun to trace the variants of these stories. Here is the English 'Tom Tit Tot', which they call 'Rumpelstiltskin'. Here is 'The Sleeping Beauty', as 'Briar Rose'. Here is the Finnish tale, 'The Partners', as 'Cat and Mouse in Partnership'. Here is 'The Three Sillies', as 'Clever Elsie'—and a dozen others. Even a story of the Far East called 'Hafiz the Stone-Cutter' is here as 'The Fisherman and His Wife'. How did these tales travel? What wandering story-teller or ragged gipsy brought them into Central Europe?

Some years ago Louis Untermeyer translated into English some German-Swiss stories and called the book 'The Fat of the Cat'. They have a medieval flavor and make one think of twisted, cobbled streets, of old convent gardens and gabled house-tops. The title story is subtle and amusing, a favorite with adults as well as with children.

Germany's hero story is common to Germany, Norway, and Iceland. In Germany it is called 'The Nibelungenlied', and it is the foundation story for Richard Wagner's cycle of operas, 'The Ring'. The form in which the great tale is told is clearer and more objective in Iceland and Norway; so we will cross the sea and find it.

The Scandinavian Countries

In Norway the Siegfried story is called 'The Volsunga Saga'. The hero must be born to rid the world of evil. He must forge his sword, keener and sharper than any obstacle that it encounters; he must find his horse that can carry him unharmed through fire and water. Then his adventures begin. There is a dignity, a splendor, about this old saga that makes it stand high in the folk-lore of all the world. Mystery is in it, dark plots, and splendid battles. The English poet William Morris wrote a prose version called 'The Story of Sigurd the Volsung'. He wrote too, with Eirikr Magnusson, a translation into English blank verse, 'The Volsunga Saga'. For the younger boys and girls James Baldwin has told a good deal of the saga in clear direct fashion, in his 'The Story of Siegfried'. It is illustrated by Howard Pyle.

The Norse peasant tales are so vivid with the spirit of Norway that to read them in a good translation is almost to see the country. Here are pine forests and rocky hillsides, prosperous farmlands and frozen brooks and rivers, white birches, dark sea-water creeping up into narrow fiords. Here we meet the fearsome trolls, and "Boots," the younger son who always manages to win the Princess. White bears wander among the pine trees, and the heroine follows her lover "east o' the sun and west o' the moon."

Lazy Jack, drawn by J. D. Batten for 'English Fairy Tales', by Joseph Jacobs. (Putnam.)

They are grand tales to tell at Christmas time, because they always seem to suggest the scent of pine needles in the sun, the log fire roaring up the chimney, and the snow lying thick and white on field and hillside. They have been lucky, too, in translation. Collected by Asbjörnsen and Moe, they were put into English in the 19th century by Sir George Dasent. His work on them is both deeply human and scholarly. Some editions contain his preface, which is an invaluable study of folk-lore in general, warm with his own enthusiasm, and an incentive to anyone who has a desire to follow the path of the folk-tales around the world.

In Sweden some of the old stories were collected by Zacharias Topelius, and retold later by Frances Jenkins Olcott in a book called 'Canute Whistlewinks'. Selma Lagerlöf's 'The Wonderful Adventures of Nils' is not, of course, folk-lore, though some old legends are woven into it, notably the story of Glimminge Castle and the epic war between the Black Rats and the Grey Rats, and the Easter legend of the city buried under the sea. But it is so completely a picture of Sweden, of the farms and meadows, the medieval towns and quaint villages, that the story-teller would do well to follow Nils on his flight with the wild geese.

The story of the old witch and her treasure in a long leather bag is known in many countries in varying forms. Here it is illustrated for the version in 'More English Fairy Tales', edited by Joseph Jacobs. (Putnam.) The drawing is by J. D. Batten.

In Denmark we must stop for a moment to pay tribute, not to folk-tales, but to one of the greatest of all imaginative writers, Hans Christian Andersen. His exquisite fairy stories do not belong to any folk-lore, but they are as well known as any group of authentic folk-tales—perhaps better.

The British Isles

When we come to the heart of the British Empire we find five separate folk-lores. Taking Scotland first, we meet at once the Scottish Brownie, nearest to human of all the "over the border" people. The tale of how he departed to the hills forever is told in Elizabeth Grierson's 'Tales from Scottish Ballads' and is called 'The Brownie of Blednock'. It is a quaint, sad story. In Scotland we find too the old, old story of Habbetrot the Spinner, which Beatrix Potter tells again in her 'Fairy Caravan'. Here are Tamlane and Tam o' Shanter, and the stories—half history, half legend—of the Border romances and the wars of the clansmen.

Going south we find the Anglo-Saxon epic 'Beowulf'. All the qualities that make John Bull what he is to the world seem to be in its hero, who killed the frightful beast Grendel; who won his way to a throne; and who ruled wisely and justly as England has ruled so often since in remote corners of the earth. The words that describe his death and burial in the poetic version of his story are the very essence of England; as much a part of her as the soil in which her "oak and ash and thorn" find their sustenance.

The shorter folk-tales are just as characteristic. Who can stand on Highgate Hill and not remember Dick Whittington and the Bow Bells? Who can read the adventures of Mollie Whuppie and not recognize that she is English to the very backbone? Joseph Jacobs has retold the stories in a most satisfactory manner in his 'English Fairy Tales' and 'More English Fairy Tales'. He has added to them the quaint old "drolls"—'The Teeny Tiny Woman', 'Master of All Masters', and 'Strange Visitor'. One can spend many happy hours tracing Tom Thumb and Jack the Giant Killer back to the chapbooks and "twopenny sheets" that scattered the stories far and wide before they were gathered into books.

Going on into Cornwall, we find the pixies, those strange impish little creatures who do not seem to belong in England and were perhaps brought from the East in the days when the Phoenicians came over to mine tin. Enys Tregarthen has told the pixie tales in a little book called 'North Cornwall Fairies and Legends'. It has long been out of print, but someone should bring it back! Nowhere else can one find that creepy tale of 'How Jan Brewer Was Piskey-Laden', or the legend of the queer little stone horsemen on the church at Padstow. We cannot afford to let a modern generation grow up without the pixies!

It is in Devonshire and Cornwall, and farther west in Wales, that we find the legends of King Arthur and his knights. Traces of them are found all over the British Isles, but they seem to live most vividly at Tintagel. Here on a rocky promontory are the

ruins of Arthur's Castle. Here is the cave where Merlin kept him secretly when he was a baby. Standing here, looking north and west over the Irish Sea, we can surely see the ship that brought Tristram and Isolde back to King Mark's treachery. And when the picture, glowing with life and color, has sunk deep into our minds we can go up to the village for tea, with the famous Devonshire clotted cream, Devonshire "splits," and strawberry jam!

The great King Arthur cycle was first written in English by Sir Thomas Malory and printed by the Caxton press in 1469. Howard Pyle's genius, both as writer and as artist, has given it to modern boys and girls. Those three square volumes of his, with their brown covers decorated in black and gold and red, will probably be the favorite source for the Arthur stories always. Miss Shedlock tells a curious story of how Arthur and the knights were awakened from their long slumber by a modern Englishman, who finds their cave by means of a magic rod given him by a stranger on London Bridge. It is in her book, 'The Art of the Story-Teller'.

Wales has its own ancient epic tale, 'The Mabinogion', which probably was written before Sir Thomas wrote the Arthur cycle. Sidney Lanier wrote the popular version, calling it 'Knightly Legends of Wales'. Recently Padraic Colum has told it in his 'Island of the Mighty'. There is still another modern version with illustrations by Ferdinand Horvath. It is called 'The Book of the Three Dragons' and is by a Welshman, Kenneth Morris.

The son of the Wonder-Smith, with his milk-white hound by his side, sets off through the forest on his quest. Boris Artzybasheff's drawings convey the strange beauty of the Irish legends in 'The Wonder-Smith and His Son', told by Ella Young. (Longmans.)

Now we cross the Irish Sea to find the Celtic stories told in that matchless cycle called the 'Tuatha da Danaan'. Irish poets and dramatists and story-tellers have told and retold it through the centuries. It is as much a part of an Irishman as the air he breathes. Beginning with the earliest of the Celtic Kings, it brings us down through Cormac and Finn MacCool and Cuchulain to the peasant tale that is still told before the peat fire in the hillside cabins. It is hard to say which part of it is the most dramatic. William Butler Yeats says of the Celtic heroes: "No thought of any life greater than that of love, or the companionship of those who have drawn their swords upon the darkness of the world ever troubled their delight in one another, as it troubled Iseult and her lover, or Arthur and his battles."

The greatest, perhaps, of the heroes is Finn MacCool. A metrical version of his story gives a fairly clear idea of him:

These are the things that are dear to Finn,
The din of battle, the banquet's glee,
  The bay of his hounds through the rough glen ringing,
And the blackbirds singing in Letter Lee.
The shingle grinding along the shore
  When they dragged his war boats down to sea,
  The dawn wind whistling his spears among,
And the magic song of his minstrels three.

One of the finest bits of prose in all literature is the Fairy Woman's prophecy to Queen Maeve in the

Cuchulain story. Standing before the haughty Queen in the twilight of the fields, she says:

Through all my dreams there comes a lad, young though he is the marks of many wounds are on his skin, and round his head there shines the hero's light. A face he has the noblest and the best and in his eyes sparkles the champion's gleam. A stripling, fair and honest in his home, but in the battle fierce and tough and strong as though he wore a mighty dragon's form.

By him your hosts are all hewn down. And on the battlefield the slain, foot laid to foot and hand to hand, do lie. Before the hosts of Ulster all unmoved he stands as if to guard them from the fight.

To all the world this youth's name shall be known—Cuchulain, son of Sualtach of the Feats. But in the North, because he guards their homes as a good watchdog guards the flocks upon the mountain side, men call him lovingly—The Hound of Ulster.

The writers who have told these famous tales form a brilliant group: Padraic Colum, James Stephens, Lady Gregory, Ella Young, and many others. They are listed in the bibliography that follows this article.

The pure peasant tale has been told, very well, by Seumas MacManus. His 'Donegal Fairy Tales' and 'In Chimney Corners' have all the Irish wit and the Irish love of high adventure between their covers. All these tales are more effective told than read. They need the changes of the human voice, the sense of *something shared*, that the proper kind of story-telling always gives. Here in Ireland there is something to satisfy every mood. Nothing could be jollier or more absurd than the adventures of 'Billy Beg and His Bull'. Nothing could be sadder or more romantic than the story of the children of King Lir, who were condemned by a wicked stepmother to float as swans on the lakes of Ireland for nine hundred years. As Ella Young tells it in her 'Celtic Fairy Tales' the very words are music—the faint, eerie music of the swan's song.

Greece

The path of the stories leads us now back across Europe to the shores of the Adriatic Sea, to the country that has given so much of beauty—Greece. The Greek myths have been told for younger children by Elsie Buckley in her 'Children of the Dawn'—a book that carries in it a sense of spring and the youth of the world. For the older boys and girls there are W. M. L. Hutchinson's 'Orpheus and His Lute', and Nathaniel Hawthorne's 'Wonder Book' and 'Tanglewood Tales'. Homer has been retold in prose for the younger generation of readers by Padraic Colum. He includes both the 'Iliad' and the 'Odyssey' in his book, which he calls 'The Adventures of Odysseus and the Tale of Troy'. In his 'Odysseus, Sage of Greece', Alan Chidsey gives us the 'Odyssey' in prose.

The story of the Three Golden Apples is found in Ella Young's 'The Unicorn with Silver Shoes', illustrated by Robert Lawson. (Longmans.)

Aesop's fables have been edited and translated and illustrated so many times that the roll-call of workers concerned in it includes almost every nationality and a host of famous names. The latest edition is one of which America and the 20th century may well be proud. 'Aesop's Fables, Edited and Illustrated by Boris Artzybasheff' is a fine example of the re-creation of an old classic by an artist whose sense of humor, sympathy with his subject, and superb technique are worthy of these stories that have been for centuries a part of our inheritance. It is a book that has a special appeal to the boys and girls of today.

The Romance Countries

Across the Adriatic from Greece lies Italy. No one who really knows Italy and the Italians can doubt their possession of a rich and dramatic folk-lore. Their ability to tell a story, and to tell it well, is as much a part of them as their flexible, expressive hands. When it is told by an Italian to Italians, the most commonplace incident becomes a drama.

Their hero story is their own version of the story of Roland, 'Orlando Furioso', written by Ludovico Ariosto and published in Tuscany in 1516. It is still played in its entirety throughout Italy by puppeteers.

In the 17th century Gianbattista Basile brought together the folk and fairy tales in a volume known as the 'Pentamerone'. He wrote it in a Neapolitan dialect that has since been completely discarded, and for many years it has been practically forgotten. Not long ago the poet and scholar Benedetto Croce, with the help of other scholars, wrote the tales in modern Italian, and Prof. N. M. Penzer translated them into English. This is an intensely human document, interesting not only to folk-lorists and book lovers, but to anyone who cares to follow the social development of a race. Shrewd, naïve, humorous, the stories reveal more of the true Italy than can be found in volumes of history.

Up in the north, in Tuscany and Umbria, Luigi Capuana gathered the old stories and put them into two volumes, 'C'era una volta' and 'Fiabe'. Dorothy Emmrich has translated them into English, calling the books 'Italian Fairy Tales' and 'Golden-Feather'. They are so characteristic of the Tuscan peasant that to read them is to hear him speak! The harvest story 'Ti Tiriti Ti' is literally an index of his failings and his virtues. It tells of the magician Sabino, who in the form of an old peasant grows a marvelous field of corn by simply standing in the field and playing a tune on his pipe. The jealousy of the other peasants and even of the King, the way in which Sabino works on their emotions to gain his ends, the

careless generosity of his final gesture, and the supreme importance of the grain—these make up a shrewd, primitive picture of Tuscan peasant life. In her 'Truce of the Wolf' Mary Gould Davis retells from the 'Fioretti' the story of St. Francis and the

"Ti, tiriti, ti," plays the peasant on his pipe, and even the fields heed the magic of his music.

Wolf of Gubbio. She tells too a number of the "place" legends of Florence, among them the tale of the famous Bronze Boar, the "Porcellino" who stands before the Mercato Nuovo and serves as a drinking fountain to small Florentine boys of today. But, traveling over the white winding roads, stopping for the night in the picturesque old cities, one feels that much of Italy's folk-lore still lies buried in the minds of her people. Every peasant, every townsman, knows stories which are yet to be written down in books.

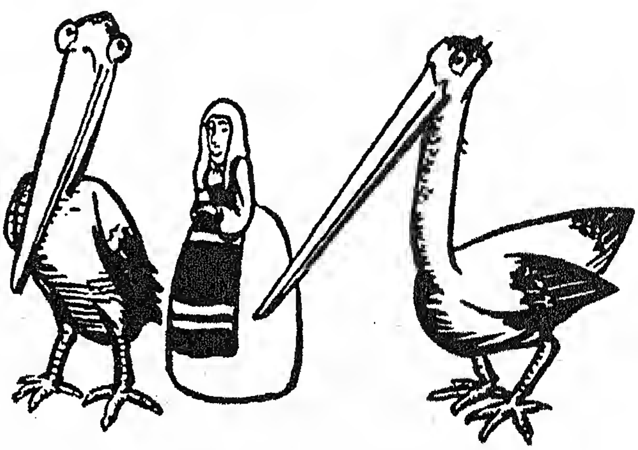
France is so rich in stories that we turn to her with the wish that we could spend a lifetime in appreciation of them. To her belongs the most appealing, the most radiantly alive, of all the hero tales, 'The Song of Roland'. Henry Adams says of it:

> No modern opera or play has ever approached the popularity of the Chanson. None has ever expressed with anything like the same completeness the society that produced it. Chanted by every minstrel,—known by heart, from beginning to end, by every man and woman and child, lay or clerical,—translated into every tongue,—more intensely felt, if possible, in Italy and Spain than in Normandy and England,—perhaps most effective, as a work of art, when sung by the Templars in their great castles in the Holy Land,— it is now best felt at Mont-Saint-Michel, and from the first must have been there at home.

It was first sung by Taillefer, the minstrel of William, Duke of Normandy, in the 11th century. To his male hearers, who must have lived a life somewhat similar to that of Emperor Charlemagne and his knights, Roland was simply a determined and fearless man, who lived as other men and died for France. Those human qualities of his—youth, courage, pride, impulsiveness—are reflected in some of the translations of the Song today, so that he seems as near to us as the men who died for France in the Great War. A satisfying version of his story in prose has yet to be written. And why it has not been written is a mystery. No one who has followed Roland through his own country can fail to be deeply moved by it. The battlefield of Roncesvalles, where he laid the bodies of Oliver and of Archbishop Turpin and sank under a great beech tree "to give his soul to God," is still as it was in his day, more than a thousand years ago. Up there on that high pass, with the Gave River rushing down from the melting glaciers above, with the fair green plains of Provence spread out below, the tragedy of his death re-creates itself and the great words of the Song sing themselves in our minds. To every Frenchman, it is the very heart of France.

Almost as constant in its popularity is the quite different story of Reynard the Fox. It, too, was first written in the 11th century, and it has been a vehicle for satire and fun ever since. There has never been such a villain—bird, man, or beast—as Reynard. He was everything that one should not be, he broke every law, even flouting the holy customs of the Church. But where else can one find so attractive a sinner? The trial scene is one of the wittiest, cleverest things that French literature has produced. Its wit and its cleverness have become, as it were, part of a Frenchman's inheritance. Reynard's story should be read in its native tongue, in the edition with drawings by Vimar. No translation into English can do it justice.

To France we owe the famous collection of fairy tales told by Charles Perrault to the ladies and gentlemen of the court of Louis XIV. Sir George Dasent says of them: "Among the French tales we have passed from the woods and fields and hills to my



Both illustrations on this page are drawn by Margaret Freeman for 'Italian Fairy Tales', told by Luigi Capuana. (Dutton.)

lady's boudoir." And that exactly expresses the difference between 'The Sleeping Beauty' and the German variant, 'Briar Rose'. The mark that the witty French lawyer and scholar left on these tales can never be effaced. What a scene it must have

been! That formalized, magnificent court, those sophisticated, blasé men and women! And in such an atmosphere the simple, romantic stories of 'Red Riding Hood' and 'Puss in Boots' and 'Cinderella'! To visualize this scene one should have the big picture book by Job, called 'Le Roi Soleil'. The stories were soon translated into English and became very popular in England during the late 17th and early 18th centuries. Madame la Comtesse d'Aulnoy followed Perrault, telling her charming tales in very much the same way. It remained for the 20th century, however, to give them the absolutely right format. In 1928 there was published an edition of Madame d'Aulnoy called 'The White Cat'. It is edited by Rachel Field and illustrated by Elizabeth MacKinstry. Each character in the stories is dressed in the costume of the period in which they were first told. Every page of the book reflects the grace and stateliness of that stately and gracious time. To put this book into the hands of a girl is to give her, not only fairy tales, but a vivid sense of something that is definitely past—and that will never come again.

Chanticleer bemoans the loss of his dear wife, killed by the treachery of cruel Reynard. Both pictures on this page were drawn by A. Vimar for 'Le Roman de Renard'. (Librairie Renouard. Paris.)

When we reach Spain we find that the peasant folk-tales have not yet been translated into English, in any form that would truly represent them. One of the cycle of stories about the royal mouse, Perez, has been retold in its Puerto-Rican form by Pura Belpré in her 'Perez and Martina'. Illustrated by Carlos Sanchez, it is a "picture-book" story that has won many friends among both children and adults. On the island of Majorca a collection of native tales has been translated by George and Beatrice Dane under the title 'Once There Was and Was Not'. The stories are lively and individual; one could wish that there were more of them. Washington Irving's legends of the Alhambra will stand, of course, for all time.

The Spanish hero story is half history, half legend. Rodrigo de Bivar lived in the 11th century and is known all over the world as "The Cid." Southey translated his story into English, and it became as popular in England as in Spain. A version of it that boys and girls like is 'The Tale of the Warrior Lord', by Merriam Sherwood. There remains much Spanish folk-lore to be collected and written down. As in Italy, a traveler is constantly coming across animal fables and peasant tales that reflect the life of old Spain.

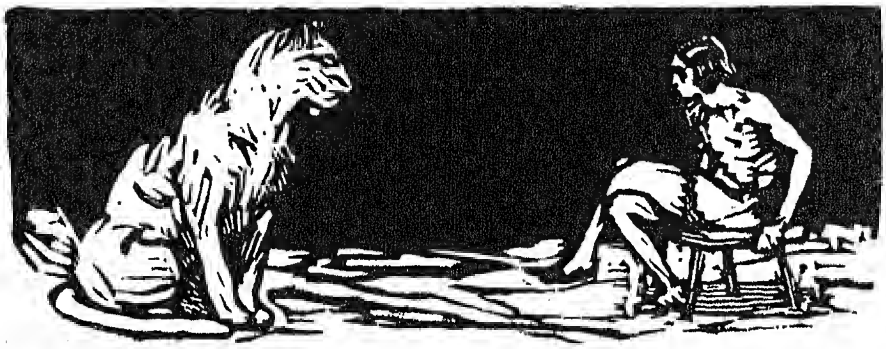
Sly Reynard succeeds in tricking even the Lion. A. Vimar depicts clearly the personalities of the animals who appear in this beast-epic.

The Two Americas

It is through Spain that we finally come in our wanderings to the New World. The Spanish settlers and missionaries, coming to South America and to the southwestern part of North America, brought with them their faith, their language, and their culture. All three of these have left their impression upon the stories of the two Americas.

Not much of the native folk-lore of South America had been written for children until 1926. Then came a book like a fresh wind to blow away weakened and "written down" folk-tales and to give a vivid sense of the South American Indians. Charles Finger, who

collected and wrote these stories, calls his book 'Tales from Silver Lands'. The "origin story" of the monkey, called 'The Tale of the Lazy People', is a fascinating thing for any student of folk-lore. One needs to know Spanish to tell it properly because it uses Spanish terms that defy translation. The old man in it is the forerunner of the modern philosopher. Through his wisdom and his study of the human mind, he knows what people want and need better than they know themselves. The last story, 'The Cat and the Dream Man', is on a theme that has concerned the human mind for centuries—the power of dreams. Here, too, the evil thing that is projected from the cat's "subconscious" self while she dreams is conquered by the skill and strength of a boy, a hero who, while he is always a primitive Indian, is curiously modern and sympathetic. This is an unusual collection, and its "holding power" with boys and girls has been proven again and again. The illustrations, woodcuts by Paul Honoré, blend perfectly with the freshness and vitality of the text.



The cat, a monster of evil heart and a curse to the world, confronts the little boy who later overcomes her. Drawn by Paul Honoré for 'Tales from Silver Lands' by Charles Finger. (Doubleday.)

The Spanish influence still holds through Central America and Mexico, and into California. Monica Shannon has collected the border stories in a book called 'California Fairy Tales'. In New Mexico and Arizona the Zuñi tales are pure Indian. They have been collected by Frank Cushing, who tells them in his 'Zuñi Folk Tales'. His variant of 'Cinderella', 'The Poor Turkey Girl', is interesting. Aileen Nusbaum has rewritten some of them in her book which was called first 'The Seven Cities of Cibola'. The new edition is 'Zuñi Indian Tales'. Her book is illustrated with authentic Zuñi drawings, which give it an added value.

As we go further north, both east and west, we find each Indian tribe with its characteristic stories. In some cases they have been very well rewritten; in some they are not ready yet for the general reader. One delightful collection of the fables of the Pueblo Indians has several variants that challenge the followers of folk-lore. There are two volumes, 'Taytay's Tales' and 'Taytay's Memories', and they are illustrated with simple primitive drawings by two Pueblo boys. 'The Pine-Gum Baby' story is obviously a variant of the Uncle Remus 'Tar Baby', which is supposed to have come originally from Africa. 'The Fox and the Lizard' is very much like the German tale of 'The Wolf and the Seven Little Kids'. Elizabeth DeHuff, who tells them, has wisely left them just as old Taytay, the grandfather, told them to her.

The Indian stories that seem most representative are those that are told by George Bird Grinnell from the records of the Blackfoot tribe. Here are the Indian heroes who appeal most strongly to American boys, masters of the science of primitive living, strong, brave, self-controlled. The legend of the tribal hero, Scarface, has a breadth, a dignity that places it high in the hero stories of the world. Scarface was the first "pioneer," the first man to cross the Great Divide and see the dim outline of the Pacific Ocean stretching away to meet the horizon. That journey of his is prophetic of the fur traders and the covered wagons that were to bring the "white man's rule" to the western limit of the continent. Every detail is authentic. Even the words are grave and stately, and a little remote. It is a tale that stirs the blood of every native American.

Arthur Parker's 'Skunny Wundy' gives the Indian animal fables, amusing, authentic, and revealing. Up in Alaska there is another Indian hero story that has recently been told for boys and girls in two books—'Old Raven's World' by Jean Maury, and 'The Box of Daylight' by W. H. Hillyer. It is a "creation" story in which the lower world is prepared for man by the Indian god Raven, who steals light and heat for earth from the other gods. There are strange primitive things to be conquered before man is safe. Raven's adventures read something as the Finnish 'Kalevala' reads. They have the quality of an epic, strong, masculine, moving on to the inevitable end—man's victory over evil.

Paul Bunyan (or Bunyon) certainly belongs in American folk-lore. We like to think him the link between the Indian tales and the stories of today. According to James Stevens, Paul Bunyan originated in Canada among the French-Canadians in the early years of the 19th century. His origin is, and probably always will be, a matter of dispute between the Maine woodsmen and the lumbermen of the Northwestern camps. Whatever its beginning, Paul Bunyan's legend certainly *grew*, as a snowball grows when it is rolled down a sloping hillside. It grew out of the American love of "tall talk," out of our boastfulness, our naïve desire to "show off." It grew, too, out of native humor and kindliness. Paul was, in

many ways, a typical American. He corresponds to that keen analysis of Rudyard Kipling's, the ending of which brings a certain sense of satisfaction to all Americans:

And while reproof around him rings
He turns a keen, untroubled face
Home—to the instant need of things.

James Stevens' 'Paul Bunyan' is probably the best known. Esther Shephard has written a simpler and more "native" version. The one that seems nearest of all to Paul himself is published by The Red River Lumber Company. Underneath all the absurd exaggeration, the rough fun of the saga, there is a rugged beauty—the beauty of pine forests, of rushing rivers, of snow-capped hills against the sky. It expresses early America, with man only a puny being who matches his brains and strength against the mightier forces of nature (*see* Bunyan, Paul).

Two Indian boys, Fred Kabotie and Otis Polelonema, made the drawings for 'Taytay's Tales', by Elizabeth DeHuff. (Harcourt.)

The Negro stories, too, are part of American folklore. If the Uncle Remus tales did come originally from Africa, they belong now to the southern Negro. We owe Joel Chandler Harris a debt of gratitude for recording them. And we also owe a debt to A. B. Frost, whose drawings of the animals are as humorous, as full of meaning, as the tales themselves. An important record, too, is in the "creation" tales of the Gullah Negroes of South Carolina and Georgia, collected by Samuel Gaillard Stoney and G. M. Shelby under the title 'Black Genesis'. The tale of how the Lord appointed Mrs. Goat to assign each animal his tail is sheer delight and is, undoubtedly, folk-lore. Down in Louisiana the legendary John Henry has added his "high deeds" to the Negro saga. Roark Bradford tells the John Henry story so well that it has become a Negro classic.

Certain isolated groups like the people of the mountains of Kentucky, Tennessee, and North Carolina have their own native tales. Percy Mackaye has told some of them in his 'Tall Tales of the Kentucky Mountains'. A number of their songs and singing games have been traced back to Scotland and England.

What will be the American folk-tale of the future? Hundreds of years from now, when later Americans look back to our "neo-technic" age, will it be Carl Sandburg's voice that will interpret us? His stories of the great fields of scientifically cultivated wheat and corn, his skyscrapers making canyons of the city streets, his telegraph poles and fast express trains, his "glorification" of homely, everyday things—these seem nearer to the modern American fairy tale than anything that has yet been written. Perhaps the sheer beauty of 'The White Horse Girl and the Blue Wind Boy' is prophetic of the beauty that is to emerge from America when the noise and stress of the Machine Age is past. Either through him or through some other poet the folk-tales of our cycle will surely come. Perhaps, as in 'The Panchatantra', we will work through experience back to simplicity.

A List of Folk-Tales from Many Lands

India

The Panchatantra. Translated from the Sanskrit by Arthur W. Ryder. (University of Chicago Press.) These stories form one of the oldest, wisest, and wittiest of books. They are for all ages, but only through experience can one fully realize their value.

The Lion and the Ox. By Vladimir Lebedev. (Macmillan.) Translated from 'The Panchatantra' through the Arabic, this is one of the liveliest and most amusing of the old tales. The drawings by a Russian artist are modern and expressive.

Eastern Stories and Legends. By Marie L. Shedlock. (Dutton.) Legends of the rebirth of the Buddha, told by a famous story-teller who gives them clarity and simplicity.

Jataka Tales. More Jataka Tales. By E. C. Babbitt. (Century.) Short and amusing, these are the stories of the Buddha rebirth as they are told by the peasants of India.

Fairy Tales from India. By Katharine Pyle. (Lippincott.) These stories are retold from a book that has long been out of print—'Old Deccan Days' by M. E. Frere.

Tales of the Punjab. By Mrs. F. A. Steel. (Macmillan.) These are the folk-tales of India, dramatic, amusing and strong in atmosphere. One of the favorite tales is 'The Bear's Bad Bargain'. The drawings by Lockwood Kipling add to the book's value.

Tales from Timbuktu. By Constance Smedley Armfield. (Harcourt.) Stories told to a Prince of Persia in the Market Place at Timbuktu. The favorite one is 'The Stone Lion'.

The Magic Bird of Chomo-Lung-Ma. By Sybille Noel. (Doubleday.) Stories from the slopes of Mount Everest that are remote and strange and rather exciting in plot. They are for older boys and girls.

Gessar Khan. By Ida Zeitlin. (Doubleday.) The hero story of Mongolia and Tibet. It is illustrated with fascinating drawings by Theodore Nadejen.

Persia and Arabia

The Epic of Kings. By Helen Zimmern. (Macmillan.) The famous story of the Kings of Persia translated from the poet Firdusi, into clear and vigorous English. The Rustam story is one of the finest of all hero tales.

Rustam, Lion of Persia. By Alan Chidsey. (Minton.) This is for older boys and girls—a traditional story of "high adventure."

The Ivory Throne of Persia. By Dorothy Coit. (Stokes.) Part of Firdusi's 'Shah Nameh' told for younger children. It was presented as a play by the children of the King-Coit School in New York.

The Romance of Antar. By Eunice Tietjens. (Coward.) The traditional tale of an Arabian poet and warrior who was "like no other child born of the desert, like a fragment of a thunder cloud."

The Arabian Nights. Edited by Kate Douglas Wiggin and Nora A. Smith. (Scribner.) This is a well-edited edition, with pictures in color by Maxfield Parrish.

A Jackal in Persia. By Major C. F. Mackenzie. (Doubleday.) This is, as far as we can tell, a Persian version of 'The Panchatantra'. Younger children enjoy it, and the drawings by the Baroness Dombrowsky are delightful.

China

Myths and Legends of China. By E. T. C. Werner. (Farrar.) A scholarly collection of the "background" stories of old China.

Shen of the Sea. By A. B. Chrisman. (Dutton.) Lively and amusing folk-tales that tell the origin of tea, of chopsticks, and of dragons. Many of them are good to tell at Hallowe'en.

A Chinese Fairy Tale. By Laurence Housman. In his 'Moonshine and Clover'. (Harcourt.) The dramatic and appealing story of a Chinese boy who grew to be a great artist.

Japan

Japanese Fairy Book. By Y. T. Ozaki. (Dutton.) This is an excellent translation of the traditional folk-tales. It includes the famous harvest story, 'My Lord Bag of Rice'.

Green Willow and Other Japanese Fairy Tales. By Grace James. (Macmillan.) These are the more romantic folk-tales. Older girls especially like the story of 'The Black Bowl'.

Japanese Fairy Tales. By Lafcadio Hearn. (Boni.) Not all of the tales in this book were written by Lafcadio Hearn, but everyone will want to read his fascinating story of 'The Boy Who Drew Cats'.

Prince Bantam. By May McNeer and Lynd Ward. (Macmillan.) A hero story of old Japan. The romance in it appeals to older girls, and the giant, Benkei, appeals to everyone.

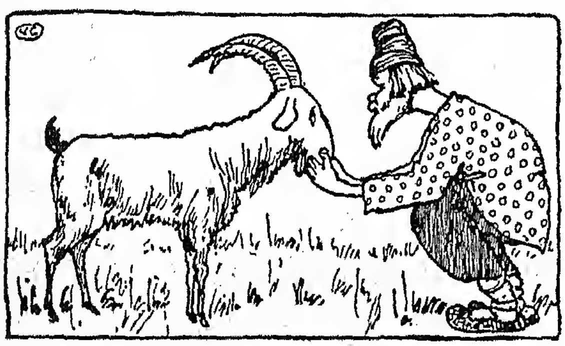
Russia

Skazki. By Ida Zeitlin. (Farrar.) A version of the Caucasus tales, many of them translated directly from the Russian poet, Alexander Pushkin. The drawings are by Theodore Nadejen.

Russian Wonder Tales. By Post Wheeler. (Century.) The lovely, colorful folk-tales of the Caucasus retold by a scholar who has kept their rhythmic beauty. The illustrations are by Bilibin.

Humpy. By Peter Yershov. (Harper.) A modern version of the tale of 'The Little Humpbacked Horse'. It is one of the most popular of the Russian folk-tales.

Old Peter's Russian Tales. By Arthur Ransome. (Nelson.) An attractive edition of the authentic tales of old Russia.



The Quarrelsome Goat, drawn by Valery Carrick in his 'Still More Russian Picture Tales'. (Stokes.)

Picture Tales from the Russian. By Valery Carrick. (Stokes.) This, and the companion volumes, tell in words and in pictures the peasant tales of old Russia. They are very simple and very amusing.

To Your Good Health. In 'The Art of the Story-Teller'. By Marie L. Shedlock. (Appleton.) This amusing story is a great favorite for the Story Hour. Miss Shedlock includes it in her invaluable book on story-telling.

Wings. By Fedor Sologub. In 'Twenty-Four Unusual Stories', by Anna Cogswell Tyler. (Harcourt.) A modern Russian story that appeals strongly to older girls. It has the "feel" of the real Russia.

Finland

The Kalevala. The Epic Poem of Finland. Translated into English by John Martin Crawford. (The Robert Clarke Company.) A metrical version of 'The Kalevala'. Children are quick to recognize the meter of Longfellow's 'Hiawatha'. If they like 'The Sampo' and 'The Wizard of the North', this should be added to their library.

The Sampo. By James Baldwin. (Scribner.) This is the Finnish epic poem—'The Kalevala'. Told simply and objectively for boys and girls, it preserves the action and characters of one of the greatest of the old epic tales.

The Wizard of the North. By Parker Fillmore. (Harcourt.) Another version of 'The Kalevala'. It has more humor than 'The Sampo', and is closer, perhaps, to the people. The boys and girls usually like 'The Sampo' better.

Mighty Mikko. By Parker Fillmore. (Harcourt.) The Finnish folk-tales, told with spirit and humor. The title story of the clever little fox is a favorite everywhere.

Czechoslovakia

Czechoslovak Fairy Tales. By Parker Fillmore. (Harcourt.) There are at least two stories in this book that almost all boys and girls like—'The Devil's Match' and 'Katcha and the Devil'. They are very old, very true to Czech peasant life and full of fun.

The Shoemaker's Apron. By Parker Fillmore. (Harcourt.) This volume of the Czech folk-tales is a favorite with little children because it includes 'Budulinik' and 'Smolicheck', two good stories to tell or to read aloud.

The Laughing Prince. By Parker Fillmore. (Harcourt.) Another collection of the Czech folk-tales. It includes the story of 'The Girl in the Chest'.

The Disobedient Kids: and Other Czechoslovak Fairy Tales. By Bozena Nemcova. (Koci. Prague.) A large, attractive book that gives the simpler Czech folk-tales, including 'Smolincek', with colorful illustrations by Artus Scheiner.

Beyond the Giant Mountains. Translated from the Czech of Adolf Wenig by Lillian Mokrejs. (Houghton.) These are Bohemian "devil" stories—cryptic, amusing, and characteristic. They are for older boys and girls.

Germany

Household Stories by The Brothers Grimm. (Macmillan.) There are many editions of these tales, but this one, illustrated by Walter Crane, is a friendly and comfortable book to own and to enjoy.

The Fat of the Cat. By Gottfried Keller. (Longmans.) These German-Swiss tales, retold by the poet, Louis Untermeyer, have the atmosphere of medieval cities, of medieval magic and miracles. The title story is a favorite with grown-ups.

Fairy Tales from Brentano. Translated by K. F. Kroeker. (Stokes.) Romantic fairy tales told in the early 19th century by a German poet. It interests many boys and girls to know that the one called 'Dear My Soul' was left unfinished.

New German Fairy Tales. By Norbert Lebermann. (Knopf.) Modern fairy tales for modern boys and girls.

The Story of Siegfried. By James Baldwin. (Scribner.) This belongs under both Germany and Norway. It is the hero story that is common to both countries and that forms the motif for Wagner's great cycle, 'The Ring of the Nibelungs'.

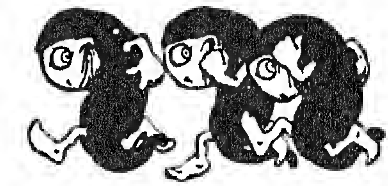
Norway and Sweden

The Story of Sigurd the Volsung. By William Morris. (Longmans.) This follows the Volsunga Saga rather than the Nibelungenlied. It is the complete story of Sigurd's—or Siegfried's—adventures.

The Swords of the Vikings. By Julia Davis Adams. (Dutton.) Stories of the Norse heroes retold from Saxo Grammaticus. For older boys and girls.

Popular Tales from the North. Translated by Sir George Dasent. (David Douglas. Edinburgh.) This early edition of Sir George Dasent's Norse stories is still in print. The preface is an invaluable essay on folk-lore, and it includes many tales that are not in the later volumes.

East o' the Sun and West o' the Moon. Translated from the Norse of Asbjörnsen by Sir George Dasent. (Doubleday.) Norwegian folk-tales in an excellent translation. The illustrations are by Kay Neilsen.



The Hobyahs, first attacking, then fleeing from little dog Turpie. Drawn by J. D. Batten for 'More English Fairy Tales', by Joseph Jacobs. (Putnam.)

Norwegian Fairy Tales. Translated by John and Helen Gade. (The American-Scandinavian Foundation.) Another translation of folk-tales that is for the student rather than for boys and girls.

In the Days of Giants. By Abbie Farwell Brown. (Houghton.) These are hero stories, told for younger boys and girls.

Stories of Norse Heroes. By E. M. Wilmot-Buxton. (Crowell.) A dignified retelling of the stories of the Norse gods.

Ola. Ola and Blakken. By Ingri and Edgar Parin d'Aulaire. (Doubleday.) Two picture story-books that tell of a little boy in Norway, his three sisters—Line, Sine, and Trine—a fierce troll-cock, and the horse, Blakken.

Canute Whistlewinks. By Zacharias Topelius. Edited by F. J. Olcott. (Longmans.) These are folk-tales of Sweden, collected by a famous scholar and retold by Frances Olcott.

The Wonderful Adventures of Nils. Further Adventures of Nils. By Selma Lagerlöf. (Doubleday.) These are not folk-tales at all, but stories by a modern writer, so vivid, so filled with a sense of the Swedish country, the animals and the people, and so beautifully written that they have the value of the old tales.

The British Isles

Tales from Scottish Ballads. By E. W. Grierson. (Macmillan.) Folk-tales for younger children. The favorite is an appealing story called 'The Brownie of Blednock'.

The Book of Ballad Stories. By Mary Macleod. (Stokes.) These are the Scottish folk ballads retold in prose. The story of Tamlane is included.

Tam o' Shanter. By Robert Burns. (Houghton.) In 'Twenty-Four Unusual Stories' by Anna Cogswell Tyler there is a very good prose version of this famous tale.

The Scottish Fairy Book. By Elizabeth W. Grierson. (Stokes.) A fine collection of folk-tales. It includes the tale of Habbetrot the Spinner, and the Christmas story of the marriage of Wee Robin and Jenny Wren.

The Fairy Caravan. By Beatrix Potter. (McKay.) In this, old Habbetrot, the sheep, tells the story of Bonny Annot and the "little, grey woman" who spins her trousseau for her.

Beowulf. In 'Hero-Myths and Legends of the British Race'. By M. I. Ebbutt. (Farrar.) Beowulf's story, his fight with Grendel and with Grendel's mother, his courage and honesty and his power as a ruler, is the great record of Anglo-Saxon literature. It is the heritage of every English-speaking boy and girl.

Beowulf, the Anglo-Saxon Epic Poem. By J. H. Cox. (Little.) This is a more difficult retelling of Beowulf's story. In the blank verse, the death scene is magnificent.

English Fairy Tales. More English Fairy Tales. By Joseph Jacobs. (Putnam.) In these two friendly volumes, edited by a scholar, we have the stories that almost everyone knows as a child—'Dick Whittington', 'Jack the Giant Killer', and 'Mollie Whuppie'.

English Fairy Tales. Retold by Flora Annie Steel. (Macmillan.) An attractive, well-made book with pictures by Arthur Rackham.

Told Again. By Walter de la Mare. (Knopf.) The old French and English fairy tales, told by a modern poet who gives them new beauty and significance.

North Cornwall Fairies and Legends. By Enys Tregarthen. (Wells.) These are legends of the pixies, those strange little creatures who are so unlike the English fairies or the Scottish brownies. Unluckily, the book is out of print. One must search for it. But it is worth any amount of searching.

The Story of King Arthur and His Knights. Written and illustrated by Howard Pyle. (Scribner.) It would be difficult to find a finer presentation of a hero story than this and the two companion volumes. In both text and drawings they measure up to the greatness of the theme.

The Boy's King Arthur; Sir Thomas Malory's History . . . Edited by Sidney Lanier. (Scribner.) Many middle-aged men and women of today knew this as children. The latest edition is illustrated by N. C. Wyeth.

The Golden Goose Book. By Leslie Brooke. (Warne.) Four English folk-tales for little children, with illustrations that are as humorous, as truly English, and as convincing as the tales themselves.

Knightly Legends of Wales. Edited by Sidney Lanier. (Scribner.) A fine retelling of the Welsh cycle, 'The Mabinogion'. The source is Lady Guest's version, written in English in 1838.

The Island of the Mighty. By Padraic Colum. (Macmillan.) This Irish poet and story-teller has made a fascinating book out of his version of the Welsh hero tales.

The Book of the Three Dragons. By Kenneth Morris. (Longmans.) A recent retelling, by a Welshman, of 'The Mabinogion'. The illustrations are interesting.

Arthur in the Cave. In 'The Art of the Story-Teller'. By M. L. Shedlock. (Appleton.) A strange legend of the awakening of Arthur and his knights from their long sleep.

Myths and Legends of the Celtic Race. By T. W. Rolleston. (Farrar.) This is not especially for boys and girls, but it is a fine "background" book for lovers of folk-lore and for story-tellers.

The Sons o' Cormac. By Aldis Dunbar. (Dutton.) Heroic stories from the 'Tuatha da Danaan', beautifully told.

The Boys' Cuchulain. By Eleanor Hull. (Crowell.) A retelling of the great tale of "The Hound of Ulster."

The Tangle-Coated Horse. By Ella Young. (Longmans.) Part of the Fionn Saga told by the author of 'The Wonder Smith and His Son'.

The King of Ireland's Son. By Padraic Colum. (Macmillan.) Old tales and legends told as they were by the Irish bards centuries ago.

Celtic Wonder Tales. By Ella Young. (Dutton.) Here is the loveliest of all retellings of the famous story of 'The Children of Lir'.

The Wonder-Smith and His Son. By Ella Young. (Longmans.) The tale of the Gubbaun Saor, the wonder-smith of the 'Tuatha da Danaan'. It is full of humor and adventure and is told as if it were a poem in prose.

The Unicorn with Silver Shoes. By Ella Young. (Longmans.) The story of Balor's Son, the Pooka and Flame of Joy, told in the words of a Celtic poet and "seer."

Irish Fairy Tales. By William Butler Yeats. (Burt.) It is a pity that there is not a better edition of these folk-tales, told by a poet who heard them as a child.

Irish Fairy Tales. By James Stephens. (Macmillan.) No collection of the Celtic stories is complete without this.

Donegal Wonder Book. By Seumas MacManus. (Stokes.) These are good stories to tell and to read aloud. An especially popular one is 'The Wee Red Man'.

Donegal Fairy Stories. By Seumas MacManus. (Doubleday.) The Irish version of 'The Golden Goose', called 'The Plaisham', is a grand tale for St. Patrick's Day.

In Chimney Corners. By Seumas MacManus. (Doubleday.) The tales that are told in front of the peat fire in an Irish cabin. Children shout with laughter as they listen to 'Billy Beg and His Bull'.

The Boy Who Knew What the Birds Said. By Padraic Colum. (Macmillan.) In this collection is one of the most popular of the Irish folk-tales—a story called 'The Stone of Victory'.

The Forge in the Forest. By Padraic Colum. (Macmillan.) Legends of fire, water, earth, and air told by a born story-teller and illustrated by Boris Artzybasheff.

The Golden Spears. By Edmund Leamy. (Longmans.) Irish fairy tales told by a poet and scholar in words that are like music.

The Voyage of the Wee Red Cap. In 'This Way to Christmas'. By Ruth Sawyer. (Harper.) A jolly, friendly Christmas story that came straight out of Ireland with a modern story-teller.

Celtic Fairy Tales. By Joseph Jacobs. (Putnam.) These are some of the Celtic tales, told simply in a companion volume to the 'English Fairy Tales'.

Greece

Children of the Dawn. By Elsie F. Buckley. (Stokes.) This is the most satisfactory volume of the Greek myths for the story-teller, and to read aloud.

The Heroes. By Charles Kingsley. (Macmillan.) Tales of the Greek heroes in a version that will never grow old.

The Golden Porch. By W. M. L. Hutchinson. (Longmans.) Stories from Pindar, called by their author "Greek fairy tales."

Orpheus with His Lute. By W. M. L. Hutchinson. (Longmans.) The Greek myths, and especially a lovely version of Persephone.

The Wonder Book and Tanglewood Tales. By Nathaniel Hawthorne. (Duffield.) The two volumes of Hawthorne's Greek myths bound in one. It is illustrated by Maxfield Parrish.

The Adventures of Odysseus and the Tale of Troy. By Padraic Colum. (Macmillan.) The major thread of both the Odyssey and the Iliad runs through this book. Boys and girls like it. It is an effective introduction to Homer.

The Adventures of Odysseus. By F. S. Marvin. (Dutton.) A prose version of the Odyssey told in a way that makes it clear and exciting.

Italy

The Pentamerone. By Gianbattista Basile. Translated from the Italian of Benedetto Croce . . . by N. M. Penzer. 2 volumes. (Dutton.) An 18th century collection of the folk-tales of southern Europe. Retold in modern Italian by a poet and scholar, they are an invaluable source to anyone interested in the social and literary life of Basile's day.

Italian Fairy Tales. By Luigi Capuana. Translated by Dorothy Emmrich. (Dutton.) The folk-tales of northern Italy as they are told by Tuscan peasants in the fields and vineyards. It includes the well-known harvest story—'Ti Tiriti Ti'.

Golden-Feather. By Luigi Capuana. Translated by Dorothy Emmrich. (Dutton.) A second volume of Tuscan tales. Boys and girls like their humor and vitality.

The Italian Fairy Book. By Anne Macdonnell. (Stokes.) Folk-tales from various parts of Italy. They are pleasant and entertaining but not very strong in background.

The Truce of the Wolf. By Mary Gould Davis. (Harcourt.) 'The Wolf of Gubbio' and other legends of Tuscany. It includes one story from Boccaccio.

Italian Peepshow. By Eleanor Farjeon. (Stokes.) These are not folk-tales exactly, but little stories that carry a strong sense of Italy. The story of the King of Tripoli is founded on a folk-tale.

France

The Story of Roland. By James Baldwin. (Scribner.) A retelling of the famous Song in direct, objective prose. It lacks the strength and beauty of Scott Moncrieff's translation, but it is probably the best that we have for younger boys and girls.

Mont-Saint-Michel and Chartres. By Henry Adams. (Houghton.) In this book Henry Adams tells the story of the making of the 'Song of Roland' by Taillefer, minstrel to the Duke of Normandy.

"Taillefer who was famed for song,
Mounted on a charger strong,
Rode on before the Duke, and sang
Of Roland and of Charlemagne,
Oliver and the vassals all
Who fell in fight at Roncesvals."

—WACE.

Chanson de Roland. Translated by Charles Scott Moncrieff. (Dutton.) The 'Song of Roland' translated into English blank verse. It has the same quality of youth and courage that we feel in Roland himself. No prose version can as effectively express the great French epic.

Reynard the Fox. Translated by C. S. Evans. (Dodd.) An excellent translation with large, clear print and clever drawings.

Le Roman de Renard. With an introduction by M. L. Tarset. (Librairie Renouard. Paris.) No one who is interested in Reynard the Fox can afford to be without this French version. The drawings by A. Vimar are so clever and so amusing that they make the plot of the story clear without the words.

The White Cat. By Madame la Comtesse d'Aulnoy. Edited by Rachel Field and illustrated by Elizabeth MacKinstry. (Macmillan.) In every detail this book is in harmony with the time and place in which the tales were first told. With it in your hands both romance and history become reality.

Les Contes de Perrault. (Librairie Renouard. Paris.) Here, in his own tongue, are nine of Perrault's tales illustrated by nine French illustrators and carrying on every page the atmosphere of 17th century France.

The Fairy Tales of Charles Perrault. With an introduction by Thomas Bodkin. (Harrap & Co. London.) The fairy tales translated very soon after their first publication by Robert Samber of New Inn in London. The drawings by Harry Clarke are very interesting.

The Tales of Mother Goose. As first collected by Charles Perrault in 1696. Translated by Charles Welsh. (Heath.) A simpler version of the famous tales, with line drawings and in an inexpensive format.

Christmas Tales of Flanders. Translated by M. C. O. Morris and illustrated by Jean de Bosschère. (Dodd.) Cryptic, amusing peasant stories in an unusually attractive book with pictures that make medieval Europe vivid and colorful.

Three and the Moon. By Jacques Dorey. With illustrations by Boris Artzybasheff. (Knopf.) Legends of Brittany, beautifully told. The illustrations are most unusual.

Spain

Perez and Martina. By Pura Belpré. Illustrated by Carlos Sanchez. (Warne.) Originally from Spain, this tale of Martina the Cockroach and Perez the royal Mouse comes from Puerto Rico. The pictures in color are fascinating and the story appeals to young and old alike.

Once There Was and Was Not. By Antonio María Alcover Sureda and Pablo Bosch y Roca. Translated by George and

Beatrice Dane. These folk-tales from the island of Majorca are Spanish in feeling. Boys and girls always find great delight in them.

The Alhambra. By Washington Irving. (Macmillan.) One of America's greatest writers tells the ghostly legends of the Alhambra.

Castles in Spain. By Bertha Gunterman. (Longmans.) A collection of legends and folk-tales of old Spain.

The Tale of the Warrior Lord. Translated from 'El Cantar de mio Cid', by Merriam Sherwood. (Longmans.) The hero story, half legend, half history, of old Spain.

North and South America

Tales from Silver Lands. By Charles J. Finger. Illustrated with woodcuts by Paul Honoré. (Doubleday.) Folk-tales of the South American Indians, exciting and dramatic and quite different from the folk-tales of Europe or of the East.

California Fairy Tales. By Monica Shannon. (Doubleday.) These are probably based on folk-tales. They show a Spanish influence against a background of southern California.

Zuñi Folk Tales. By Frank Hamilton Cushing. (Putnam.) A scholarly collection of the native stories of the Zuñi Indians. The one called 'The Poor Turkey Girl' is one of the many variants of 'Cinderella'.

Zuñi Indian Tales. By Aileen Nusbaum. With pictures by Margaret Finnan. (Putnam.) These are told for younger children. The drawings, authentic in design and color, add to the value of the book. An early edition is called 'The Seven Cities of Cibola'.

Taytay's Tales. Taytay's Memories. By Elizabeth DeHuff. (Harcourt.) The Pueblo Indian tales told by the old grandfather. The pictures are drawn by two Indian boys. The stories are primitive and amusing, something like the European folk fables.

Native Tales of New Mexico. By F. G. Applegate. (Lippincott.) Authentic stories of the New Mexican Indians. The legend of 'San Cristobal's Sheep' has great beauty and simplicity.

Skunny Wundy and Other Indian Tales. By Arthur Parker. (Doubleday.) Amusing and well-told Indian folk-tales. They are "animal" stories, and many of them give the origin of animal customs and characteristics.

Blackfoot Lodge Tales. By George Bird Grinnell. (Scribner.) This is an important collection because it includes the legend of Scarface—one of the finest and most valuable of the American Indian folk-tales.

Pawnee Hero Stories and Folk-Tales. By George Bird Grinnell. (Scribner.) Another volume of the Indian stories that appeal most strongly to American boys and girls.

Old Raven's World. By Joan Maury. (Little.) The tale of Raven, the Indian god who brought light and heat to the people of earth. It is a typical hero story and was found in Alaska.

The Box of Daylight. By W. H. Hillyer. (Knopf.) Another version of Raven's story.

Paul Bunyan. By James Stevens. (Knopf.) This begins with the winter of the blue snow and the coming of Babe the Ox. A favorite chapter is the one that tells of the famous "Black Duck Dinner."

The Saginaw Paul Bunyan. By James Stevens. (Knopf.) More of Paul's adventures with Johnny Inkslinger and Babe, the Blue Ox.

Paul Bunyan. By Esther Shephard. (Harcourt.) The Northwest version of Paul's story.

Introducing Paul Bunyan. Tales About Paul Bunyan. By W. B. Laughead. (The Red River Lumber Company.) There are three of these stories, told just as the lumbermen of the Northwest tell them.

Paul Bunyan Comes West. By Ida V. Turney. (Houghton.)

Up Eel River. By Margaret Prescott Montague. (Macmillan.) This tells of Tony Beaver, who is the "Paul Bunyan" of West Virginia.

Tall Tales of the Kentucky Mountains. By Percy Mackaye. (Doubleday.) Stories of a people who, up in their high hills, have kept unchanged a curious and individual life.

Uncle Remus. His Songs and His Sayings. By Joel Chandler Harris. With illustrations by A. B. Frost. (Appleton.) These are too well known to need any comment. America may well be proud of both story-teller and artist.

Nights with Uncle Remus. By Joel Chandler Harris. (Appleton.) Another volume of these inimitable tales.

Black Genesis. By S. G. Stoney and G. M. Shelby. (Macmillan.) The creation stories as they are told by the Gullah Negroes.

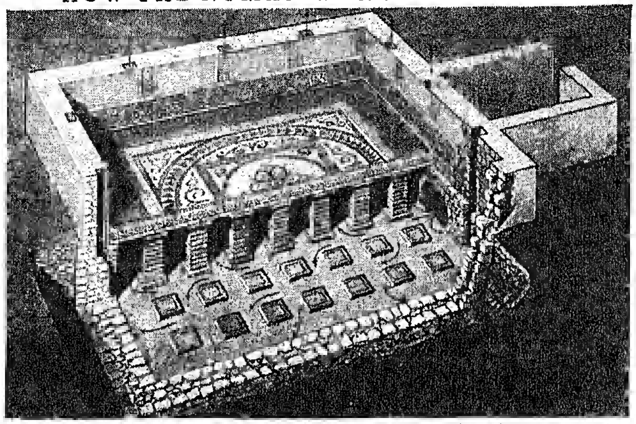
John Henry. By Roark Bradford. (Harper.) The "high deeds" of a Louisiana Negro.

Rootabaga Country. By Carl Sandburg. Illustrated by Peggy Bacon. (Harcourt.) Possibly the American folk-tales of the future.

"How to Tell Corn Fairies if You See 'em," one of the stories in Carl Sandburg's 'Rootabaga Country', is illustrated by this typically American scene by Peggy Bacon. (Harcourt.) The story is as genuinely American as the setting.

STOVES AND FIREPLACES. Portable heaters, ranging from simple braziers to cylinder-like structures partly enclosed by metal bands, were known in ancient Egypt and Greece, but were not developed into the fixed and entirely closed stove till comparatively modern times. Rich Romans warmed their homes by underground furnaces called *hypocausts;* but most Roman houses were unheated except for braziers. North of the Mediterranean, both rich and poor used open fires built on the floor. The smoke escaped through an opening in the roof or through open doors and windows. After the invention of the chimney in the 12th century, fireplaces with flues were built.

HOW THE ROMAN WARMED HIS HOME



A heating system used by the Romans is illustrated in this cross-section of a Roman house. Warm air issued from the furnace or stoke-hole at the right, and, after circulating between the numerous pillars of the ground floor, passed up through flues in the walls. The heated floor and walls kept the living-room warm.

Closed stoves appeared in Holland, Germany, and other countries of northern Europe at the end of the Middle Ages. These were great high structures of brick and porcelain tile with a small firebox at the bottom and a series of winding passages through which the heated smoke was conveyed. Stoves of this kind are still used in northern Europe. The bricks retain heat for hours, and a small quantity of wood, coal, or briquettes of coal dust will keep a room warm.

Fireplaces served the early colonists of America for both heating and cooking. Bake ovens of brick were often built into the fireplace. A fire was made in the oven, then raked out, and the bread or meat put in to be baked by the heat of the bricks.

Benjamin Franklin contributed to the development of the modern stove when, in 1745, he invented a portable fireplace of iron. This could be set out in the room, and so yield far more heat than a chimney fireplace. A modification of this iron fireplace, fitted with sliding doors, came to be known as the "Franklin stove." Further improvement on Franklin's device resulted in the box cooking-stove, with its oven below and pot-holes on top. Coal or wood stoves of this type are still commonly used in farm homes and in many of the smaller towns of the United States. The base-burning magazine stove, used for heating only, is also an outgrowth of Franklin's iron fireplace.

Stoves are more efficient than fireplaces; they deliver from 30 to 70 per cent of the heat value of the fuel against 10 to 20 per cent for fireplaces. Since most of the air warmed by a fireplace escapes up the chimney, its heating effect in a room comes chiefly from the action of the heat rays from glowing coals or flames on the walls and furniture. Fireplaces thus warm mainly by *radiation,* stoves mainly by *convection* (*see* Heat).

In cities of the United States stoves and fireplaces have been largely superseded by gas and electric ranges for cooking and by central heating systems using pipes to distribute hot air, hot water, or steam for warming. (*See* Heating and Ventilation.)

STOWE, HARRIET BEECHER (1811-1896). No book has had a more direct and powerful influence on American history than Mrs. Stowe's 'Uncle Tom's Cabin'. By its vivid descriptions of suffering and oppression, this novel inflamed the people of the North against slavery, and thus became a force in bringing about the Civil War.

Mrs. Stowe, who was born at Litchfield, Conn., belonged to the famous Beecher family. Dr. Lyman Beecher, her father, and Henry Ward Beecher, her brother, were renowned preachers. And it has been said that Mrs. Stowe, too, was first of all a preacher, and only secondarily a novelist.

In 1832 the Beechers moved to Cincinnati, Ohio. Just across the Ohio River lay slave territory. Visits to plantations quickened Harriet Beecher's hatred of slavery. Her husband, Calvin E. Stowe, a professor at Lane Theological Seminary whom she married in 1836, was also strongly hostile to slavery; and together they helped many fugitive slaves escape to safety.

Soon after moving to Brunswick, Me., in 1850, Mrs. Stowe was challenged by her sister-in-law, Mrs. Edward Beecher, to "write something that would make this whole nation feel what an accursed thing slavery is!" The answer to that challenge was 'Uncle Tom's Cabin; or, Life Among the Lowly', which appeared serially in *The National Era*, an anti-slavery paper of Washington, D. C., in 1851. It was published in book form in 1852. Though the story depicted some of the kindly and patriarchal aspects of slavery, it emphasized the dark and cruel side.

The book was hastily written, yet its drama and emotional ardor gave it a wide appeal. It has been translated into more than 20 languages, and presented countless times on the stage and in motion pictures. Its chief character, Uncle Tom, was modeled on a slave named Josiah Henson who in 1828 escaped into Canada and became a Methodist preacher.

Among Mrs. Stowe's other works are: 'The Mayflower' (1843), a collection of tales and sketches; 'Dred: A Tale of the Dismal Swamp' (1856); 'The Minister's Wooing' (1859).

STRATFORD-ON-AVON, ENGLAND. Probably no town in the world lives so completely on the memory of one famous man as the English town of Stratford on the Avon River, the home of Shakespeare. It is estimated that 30,000 people, one quarter of them Americans, visit Stratford every year.

In this ancient Warwickshire town, 93 miles northwest of London, Shakespeare was born, and here he died. Both he and Anne Hathaway, his wife, lie buried in the church of the Holy Trinity. On the slab over his grave is the famous inscription, said to have been selected by Shakespeare himself:

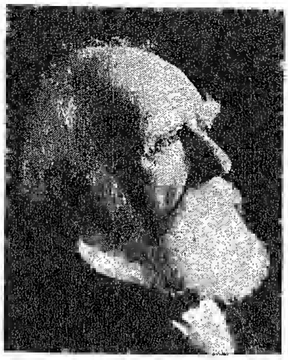
Good friend, for Jesus' sake forbeare
To digg the dust encloased heare;
Bleste be ye man that spares thes stones,
And curst be he that moves my bones.

The house of Shakespeare's parents, which contains the small whitewashed room in which he was born is still preserved. (For picture, *see* Shakespeare.) On the walls of this room appear innumerable signatures of distinguished visitors, among them the names of Walter Scott, Thackeray, and Dickens. The house serves in part as a museum of Shakespearean relics. The little thatched cottage in which Anne Hathaway was born at Shottery, about a mile from Stratford, is also a museum. At Wilmcote, near by, is the cottage of Shakespeare's mother, Mary Arden. In Stratford is a Shakespeare Memorial building, including a theater, an art gallery, and a library of his books. The theater, burned in 1926, was rebuilt by international subscriptions. Harvard House, owned by Harvard University, was the home of the mother of John Harvard, the university's founder. American visitors have given the Holy Trinity Church a stained glass window commemorating Shakespeare's poetry, and to the town a memorial fountain and clock tower.

Removed from the rush of modern industry, Stratford remains today the same pleasant, peaceful little town, with wide streets and quaint half-timbered houses, that it was in Shakespeare's day. Population, about 12,000.

STRATHCONA, LORD (1820–1914). "The grand old man of Canada," as he was called in the later years of his long and brilliant career—the man to whom in large measure western Canada owes its splendid and rapid economic development—was born in a little stone cottage in the town of Forres, Scotland, and was christened plain Donald Alexander Smith. The story of how he rose from poverty to wealth, of the part he played in transforming a wilderness into a great country, and in joining the Atlantic and Pacific by the great Canadian Pacific Railway, of how through his own great achievements he became Sir Donald A. Smith, and finally Baron Strathcona and Mount Royal, reads like a romance.

Before he was quite 18, this sturdy Scotch lad left his simple home to seek his fortune in the New World. He entered the service of the Hudson's Bay Company, which at that time controlled most of what is now the Dominion of Canada. For 13 years he roughed it in the dreary wilds of Labrador and was the first to prove that potatoes and other vegetables would grow on that bleak coast. Then he spent ten years more in the Canadian Northwest. He mastered the fur trade, he found time to read and study, and promotion followed promotion until he became the resident governor of the company, with headquarters in Montreal.



LORD STRATHCONA
"Grand Old Man of Canada"

Fur traders, Indians, and half-breeds all respected and trusted Donald Smith. So when the rebellion under Louis Riel broke out on the Red River in 1869, the Canadian government appointed him special commissioner to deal with the rebels, and to his tact was largely due the bloodless suppression of the uprising. When in 1870 the province of Manitoba was organized, he was elected to its first legislative assembly, and for many years he was a member of the Canadian House of Commons.

A man of understanding and vision, he saw that if Canada was to become a great country, if the distant parts of this vast territory were to be knit to the center, it must have a trans-continental railroad. It was largely through his financial and administrative ability, and the use of his own fortune, that the Canadian Pacific Railway was completed in 1885.

Of the vast wealth which came to him from this railroad and other sources, he gave millions to McGill University, to Victoria College for Women at Montreal, to Royal Victoria Hospital, and to many other institutions. His most unusual gift, however, was made to the British government during the Boer War, when he raised and equipped at his own expense a regiment of cavalry known as Strathcona's Horse.

Donald Smith was knighted by Queen Victoria in 1886, and in 1897 he was made a baron with the titles Strathcona and Mount Royal. In 1896 he was appointed Canadian Lord High Commissioner in London, and from that time until his death, in his 94th year, he was one of the most prominent figures in public life of the British capital. Few men did more than he to strengthen the bonds between Canada and the British Empire.

STRAUSS (*strous*), RICHARD (born 1864). The most talked of musician of the early 20th century was Richard Strauss, for in most of his compositions for orchestra he cared little for beautiful melodies, but rather tried to make his musical picture real. To do this he did not hesitate to employ the most repellently discordant tone combinations, and to use the instruments of the orchestra to produce extraordinary imitative effects. Thus the hissing of steam is produced by rubbing a drum-head with coarse brushes; the trampling of horses' feet by means of a Chinese wooden drum beaten with tubular sticks; the plashing

of rain is imitated by means of a drum filled with small stones mounted upon bearings and rotated.

Richard Strauss was born at Munich, Bavaria. His father was one of the greatest horn players of Germany and Richard early showed signs of musical talent. At four years he played the piano well, at six he was composing, and at ten he was seriously studying. Up to 1890 his compositions were not unusual, and he was known chiefly through his position as conductor of the Munich opera, rather than as a composer. From this time on, his compositions became distinctive for their radical innovations. Storms of criticism, ridicule, and abuse followed the appearance of each new work. However, time and familiarity have done much to reconcile the public to his methods and his place is now among the foremost composers and conductors of the day. In 1898 he settled in Berlin as conductor of the Royal Opera.

Of Strauss's operas, 'Salome' has probably been the most discussed, and his 'Rosencavalier' the most liked. His symphonic poems have given rise to violent discussion for and against, but his songs, because of their unfailing melodic beauty and delicate charm, have been universally accepted and have given Strauss rank as one of the great lyric masters.

STRAWBERRY. "Doubtless God could have made a better berry, but doubtless God never did." This is Izaak Walton's tribute to the strawberry in the 'Compleat Angler'. Whether you eat the wild strawberry, with its piquant flavor stored in a drop of red no larger than the tip of your little finger, or the great delicious berries, nearly as large as your fist, that are developed under cultivation in England, you agree that the strawberry is worthy of such praise. It is called the "rose among fruits," for its brilliant red is as attractive as any flower and its fragrance is as inviting.

Fortunately our favorite has been developed in many varieties adapted to a wider range of conditions than any other of the small fruits, so that it is available in the large markets every month of the year. The earliest shipments come from Florida in December, and the California season lasts through November. Strawberries are now grown in every state in the Union, but the chief commercial producers are Louisiana, Arkansas, North Carolina, Tennessee, Virginia, Maryland, and Missouri. Fresh strawberries from the home garden may be enjoyed during a long season if both early and late varieties are grown, or the perpetual or ever-bearing strawberry which bears all through the season.

In view of the fact that about 1,000 varieties of strawberries are grown in the United States today, it is surprising to learn that as late as the middle of the 19th century there were no strawberries in the city markets and few cultivated strawberry beds. Strawberries grow wild all through the North Temperate Zone and in the Andes region of South America, but little progress was made in their cultivation until a Chilean berry taken to England developed into a superior variety. Improved English varieties were later brought into the United States, but not until the Wilson berry appeared about 1840 was there a variety that could be depended upon for growth in every garden. Some of the earlier failures were due to the fact that certain kinds do not bear perfect fruit because their flowers do not produce sufficient pollen. Today varieties that are good pollen-bearers are always planted with such varieties to insure success.

A bed of strawberries is seldom kept in bearing more than a year or two. New plants may be obtained from seed, which are always depended upon for developing new varieties, and from the division of the plant head; but the usual method is to use the new plants set from runners. These are placed in rows or hills on rich well-cultivated ground. After cultivation is discontinued, and usually after the bearing season, the numerous runners loop out from the parent plant and root new plants where they touch the ground.

The strawberry belongs to the genus *Fragaria*, a name meaning fragrance. The "berry" is botanically not a berry at all, but an enlarged pulpy receptacle in which the very small seed-like *achenia* (the true fruits) are embedded.

STREET RAILWAYS. In 1917 the street railways of the United States had nearly 45,000 miles of track. Today they have less than 24,000 miles. The chief reason for this decline has been the competition of other forms of transportation—the private automobile, the motorbus, and the trackless trolley.

Between 1927 and 1937, more than half of the street and interurban electric railway companies went out of existence. The number of passengers carried decreased more than a third, and the mileage of track operated decreased by nearly 42 per cent.

Yet, despite this decline, street railways are still the most important agency of mass transportation in the cities of the United States. They carry more passengers than motorbusses, trackless trolleys, elevated and subway lines put together. They usually have more than 6½ billion passengers a year. To prevent further loss of patronage, they are installing swift streamlined cars, almost noiseless because the wheels, axles, and trucks are cushioned with rubber.

In New York and other large cities, where great numbers of people must be carried to and from a relatively small central business section, surface transportation is supplemented by rapid transit elevated and subway lines. These can operate at a speed far greater than is possible in surface traffic. They are practicable in territory that offers an abundance of "long haul" traffic, but owing to their high first cost they cannot be made to pay a return on the capital used in building them in territory where traffic is light except during certain "rush hours."

This great network of city and country, surface, elevated, and subway lines had its small beginning in 1832 when the first street-car, drawn by a team of horses, passed along the streets of New York City. Nearly 30 years later the first street railway in Europe was built in Birkenhead, England, by an American.

These early street-cars did not look much like our modern ones. They were simply coaches drawn by horses on a flat rail track. But on these tracks they could go so much faster and with so much heavier loads than coaches drawn over rough pavement that everyone became excited when first seeing them, and people cheered as the cars sped by. Some, we are told, were afraid to ride on such "fast" cars.

The Cable System

People learn quickly, however, and soon the horses couldn't go fast enough to suit them. So they began to try other means, such as compressed air motors, the moving cable, and the electric motor. Of these types, the cable railway at first proved best. A continuous wire cable running in an underground conduit between the tracks was kept in motion by a stationary steam engine placed in the power house at the end of the line. An arm on the street-car reached down through a slot into the conduit and gripped the cable when the car was to be pulled along, releasing it when a stop was to be made. Cable lines are still used over unusually hilly routes, where a self-driven car could not get sufficient grip on smooth rails to keep it from sliding back down hill.

The first electric motor to operate a car was probably one exhibited by Thomas Davenport, a blacksmith of Brandon, Vt., in 1835. But this car, as well as other early electric cars tried out in the United States and Europe, was operated by a storage battery, making it too expensive for general use. It was not until the invention of the dynamo made electric current abundant and cheap that it could be applied to street cars. The success of the electric street railway built in Richmond, Va., in 1888 by F. J. Sprague, by proving the new method practicable, established the supremacy of the electric street-car for city traffic. Twenty-five years later there were 1,000 electric railway systems in the United States. Only nine roads used animal power, the longest of these being three miles long. Eight roads used gasoline motors, and 21 used cable traction; but 11 of these were inclined-plane roads carrying tourists up the mountains.

The Modern Street-Car System

Most electric street-car systems are the same in their essential features. First of all, there are the dynamos which furnish the necessary power. In most systems the current goes out along heavy "feeder" cables, which are connected at intervals to the overhead trolley wires. A metal arm on top of the car presses a small wheel against this wire, and provides a path down which the current can run to the motors beneath the car. From the motors it runs through the car wheels to the rails, and back along the rails and through the earth to the dynamo. A "control" inserted in the circuit between the trolley arm and the motors regulates the application of power.

This general system is modified in several ways in many cities. The return current often leaves the rails, travels along water and gas mains and damages them (*see* Electrolysis), so some cities require the use of a second trolley-wire for the return current. In other cities, where the expense can be met and the danger from overhead trolleys is great enough to warrant the cost, a conduit system is used. In this a conduit with an open slot at the top is built between the tracks. The wire carrying the current from the dynamo is placed in this conduit, and an arm from the car enters the slot to draw current for the motors.

The controller is primarily a "rheostat," or switch by means of which the resistance in the motor circuits is varied. The resistance elements, or "grids," being rather bulky, are carried underneath the car, where they are cooled by the rush of air through them. By turning the control lever, the motorman starts the motors gradually by removing more and more resistance from their circuits. He reaches full speed by giving a direct path for the current. The controller has also a "reversing switch" which permits changing the field coil connections, thereby reversing the motors and the direction of travel. (*See* Electric Generator and Motor.)

A necessary part of the electrical system is the "circuit breaker," a switch which opens automatically when too heavy a current enters the motors. In old-style cars the circuit breaker was attached to the roof, above the motorman's head. You may have heard one of them "blow out" with a loud noise. In modern construction the circuit breakers are placed below the car, and are reset by electrical means.

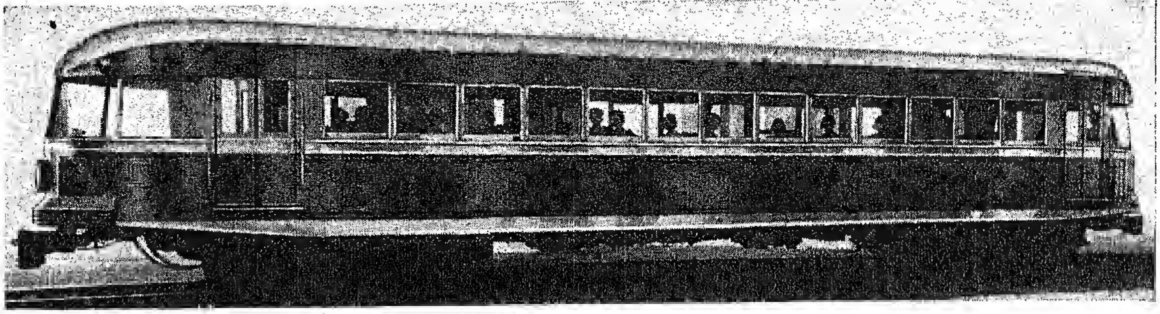
Most cars are provided with air-brakes and a hand-brake for use if the air system should fail. Perhaps you have noticed the throbbing sound that comes at times from beneath street-cars. This is the pump which maintains the proper pressure for the air-brakes, and it starts going automatically whenever the pressure falls below a certain point (*see* Brakes). All of the motions necessary to controlling the car are made as simple as possible so that the motorman can give his attention to watching the cross traffic and other conditions affecting the operating of his car.

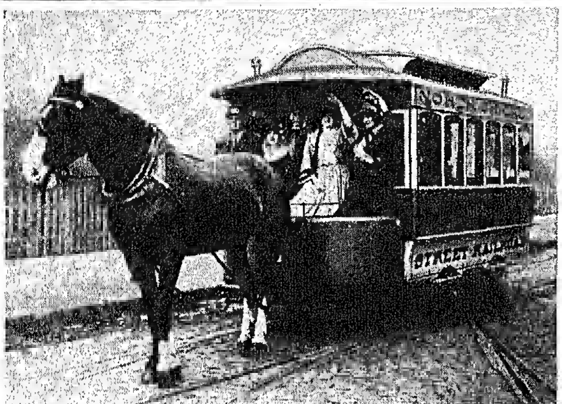
Improvements Made in Recent Years

A valuable improvement for elevated and subway lines, where cars are used in trains, is the "multiple control." The next time you stand on an elevated or subway platform, watch the operation of a train of electric cars and see how it differs from that of a steam train. When the electric train starts, the wheels begin to turn at the same time on all cars; while in the steam train the wheels of the locomotive turn first and impart their motion to the rest of the cars in turn. In the electric train there is duplicate equipment on each car, and through a device called the "multiple-unit control" the motorman, by moving the lever on the front car, controls the motors of all the cars.

Except for modernization in design and increased size, the two great recent improvements in street railways have been the direct conversion and use of high voltage alternating current where water power is abundant, and the automatic substation. In some regions cars are equipped with transformers which

THE WORLD'S FASTEST STREET-CAR—AND AN 1860 "SPEEDSTER"!





The fish-shaped, streamlined aluminum car above, in service between Philadelphia and its suburbs, speeds at from 80 to 100 miles an hour. What a change from that little four-wheeled horse-car, the last word in Chicago transportation in the 1860's!

"step down" high voltage alternating current, and with converters which change the alternating current to direct current. In city and interurban practise, however, alternating current of from 12,000 to 20,000 volts is reduced in transformers to about 450 volts alternating current. This power is changed in rotary converters to about 550 volts direct current, which is fed to the trolley lines.

Substations formerly required an operator in constant attendance to increase the power during "rush" periods, reduce it when fewer cars were running, and to watch for any derangement of the machinery. Now automatic devices perform all these duties, and the substations are run from a central station by supervisory control. A signal system of relays and wires warns an operator on duty at the central station—perhaps many miles distant—when anything goes wrong at any one of the substations.

How "Third Rail" Lines Operate

The "third rail" method of supplying current is a modern development in electric railways. The third rail, set along the track on insulators slightly higher than the other rails, carries the electric current. A metal "shoe" attached to the truck of the car slides along this rail, collecting the current and transmitting it to the motor. The third rail is used by elevated and subway lines, and by interurban lines wherever the tracks can be guarded, but it is too dangerous for city streets.

Another recent development is the "trackless trolley" which uses overhead wires to supply current, but is built like a motor-bus and runs on rubber tires. These are valuable because they do not require tracks.

An interurban railway line connects near-by towns usually in territory where the steam railroad service is poor, or where traffic is dense. Most of them carry both passengers and freight. They have brought the facilities and amusements of the city within reach of the farmer, but since 1920 they have lost considerable business to automobile, bus, and truck lines. (For relations between street railway companies and the public authorities, *see* Public Utilities.)

STRYCHNINE (*strĭk'nĭn*). In the Far East (India, Siam, Burma, Cochin-China, and Australia) grows a tree called by scientists *Strychnos nux-vomica*, which bears fruit like a small orange. This fruit has from one to five flat disklike seeds. The poisonous drug, nux-vomica, made from these contains two alkaloids, strychnine and brucine. Strychnine, which is a poisonous white powder, is used in many vermin powders. Meat poisoned with strychnine is extensively used to exterminate coyotes and other predatory wild animals. Strychnine is also used medicinally, as it is a powerful heart stimulant. A South American variety of the Strychnos tree furnishes an intense poison, *curare*, which the natives use for poisoning their arrows and darts.

STUART. The name of a royal family of Scotland and England. Robert II (ruled 1371–90), the son of Walter Steward and Marjory (daughter of Robert the Bruce), was the first Scottish ruler of the line. Robert III, James I, II, III, IV, V, and Mary followed him in succession. Mary Queen of Scots changed the spelling of the name to Stuart. James VI of Scotland, Mary's son, on the death of Queen Elizabeth became king of England as James I (1603–25), thus uniting England and Scotland under one crown, though they remained independent in every other respect. Charles I (1625–49) followed James I. The Stuart succession in England was interrupted by the Commonwealth, but was resumed at the Restoration with Charles II (1660–85). The remaining rulers of the house were James II (1685–88), his daughter Mary, who ruled jointly with her husband William III (1689–1702), and Anne (1702–14), Mary's sister, who took the throne upon the death of William.

The SECRET *of* SUCCESSFUL STUDY

STUDY. Curiosity often seems greatest during the very early years of childhood. The normal child is puzzled by the many things around him, and, not having had time to learn to solve troubles by his own efforts, he turns to parents or to friends with questions. How interesting the world is to a child may be appreciated by the barrage of questions which follows answers given by older persons. But what happens to chill the child's enthusiastic reaching out for knowledge about his immediate surroundings? Is it the impatience of the parent who does not wish to answer the questions, or who cannot answer them; or is it the necessity of having to learn under rigid school conditions? Whatever the solution of this interesting problem may be, we can be certain that successful study, like the questioning of the child, is a reaching out for answers. Unless one feels a need to learn, unless he is curious about the world, which becomes more perplexing as he grows, study is not a pleasure.

Giving Zest to Learning

Just as the child turns to parents to satisfy his curiosity, so the student turns to books, the laboratories, or teachers. From them he gains information, but unless it arouses problems and becomes a challenge to explore further the fields of knowledge, he loses the zest for learning. He talks of having to study so many pages of geography, history, or mathematics, as if study were a distasteful duty; but when he seeks answers to questions that fairly tumble out of a lively curiosity, then he rushes with willing heart and mind to find answers. Questions can always be depended upon to give zest to learning.

If the urge of questions is present, the methods by which learning progresses rapidly and accurately are readily mastered. Since teachers are present to direct a pupil's work in the classroom and the laboratory, we are here interested only in efficient habits of independent study to master the knowledge in books. Usually, a student is expected to understand a limited phase of a subject at a time; hence, he is given a unit of work to do, or what is generally called an assignment. If left to his own unaided effort, he will probably read his lesson and hope by formal repetition to learn its substance. This method of attack is deadening to intellectual curiosity and is likely to give rise to day-dreaming. A method which expresses intelligent investigation must be substituted.

First of all, by reading the whole assignment as rapidly as possible, try to find out the nature of the field covered. Do not stop to ponder difficult passages, but aim to get a general idea of the substance and to discover the arrangement of the subject matter. In this first survey, observe natural divisions of the subject, which are usually indicated by main headings, and then notice the method used by the author to develop them. It is as necessary for a student to make a survey of an assignment as it was for Commander Byrd to get a mental view of the Antarctic regions before starting on his epoch-making expedition. But to use the same attack in studying history, general science, or civics, is neither efficient nor intelligent. One must vary his reading and his method of analysis and comparison with the difficulty of the subject.

The next step is to study carefully the first division of the assignment, which may be indicated by a topical heading or determined by the first reading. Read intensively with a view to discovering either the main thought or the important facts and ideas expressed, but do not proceed farther than the first section until questions dealing with its substance have been raised and answered. Try to make questions so that the answers will require an understanding of the section, but do not ape the author's phrases. It may be hard to form good questions; practise, however, will increase skill. Perhaps, at first, it will be advisable to turn topic headings into questions, although one should learn to substitute for them others which best express his own understanding. Let us assume that in a general science course the assignment describes the composition of water. A student might well ask, "What are the properties of water as a liquid, as a solid, as a gas?" Instead of memorizing single facts as presented in a history book, a pupil might better raise questions that bind many facts together. It is desirable to write both the questions and the answers so that when the whole assignment has been outlined, a brief, accurate, and complete account is available for drill and review.

The Importance of Drill

During the first reading and the careful searching for the answers to questions, a student is learning, but he must not be satisfied until the content of the assignment is made second nature. In classroom work, in the gymnasium, in playing a musical instrument, and in study a pupil must drill until points are thoroughly mastered. If questions and answers have been written down, they will be available for drill in a form that is meaningful because it expresses a student's thinking. To secure familiarity, study the answers to each question separately and then recite upon the question by giving the answers in inner speech. During this recitation, cover up the written answers, but as soon as they have been supplied orally, inspect the notes to make a check upon accuracy. Answers should be compared with the notes; otherwise, there is a danger of repeating and fixing wrong ideas.

When drill has given a firm grasp of the subject, an intelligent pupil will stop to discover the practical meaning of his increased knowledge. Having secured information, he is now prepared to exercise judgment. He will try to relate his learning to past experience and to problems of everyday life. If the assignment expresses ideas that run contrary to his own, he should

accept the disagreement as a challenge to explore further rather than as an appeal to accept blindly what is written. These contradictions are invitations to do independent reading, or to seek the counsel of teachers and friends. By exercising judgment during study periods a pupil escapes becoming a slave to his assignments, and he learns to choose between established fact and unfounded opinion. In other words, he is becoming a free man.

The pupil should also exercise judgment as to the relative value of what he reads. A pupil who has so good a memory that he reproduces practically everything in a lesson seldom deserves praise. Such a memory merely relieves him from thinking enough to discriminate between what is valuable and what is insignificant. So long as young people have the idea that thoroughness means attention to everything, recognition of relative values will be wanting.

The outcome of good training in these two directions should be a habit of seizing quickly on the main ideas presented, and of grouping the details bearing intimately upon them around the central thoughts. Not only should relative values thus always be very prominent in study, but the soundness, in final value, of ideas in life should also be considered. Many persons have a profound respect for print, and willingly hold as valuable whatever they find in a text. But from childhood on, good judgment in this direction should be developed.

The study of an assignment is completed when another rapid reading follows drill and interpretation. How different the assignment appears when the student approaches it with understanding! Points which originally seemed unimportant now take on new and vital meaning, and details that at first seemed to be unrelated now fall into familiar settings. Frequently, new ideas and facts are suggested if the student can contribute something to the author's discussion; or similar new ideas dawn when he has more knowledge than he had during his earlier reading—adequate rewards for careful and intensive study.

"Self-Recitation" Induces Concentration

Let us examine a few of the advantages of the question-answer form of studying. In requiring us to work actively, this self-recitation method makes us concentrate our attention; whereas the typical reading of assignments encourages day-dreaming. As a result of intensive and intelligent effort our learning is more efficient and naturally our memory is better. The active search for questions and answers aids us to distinguish main points and frees us from concern over single details; but, of even greater importance, it prepares us to meet with confidence the classroom recitations, examinations, and the opportunities of talking with people. In so far as checking one's answers reveals both knowledge and ignorance, it directs effort where it is most needed and the resulting improvement becomes a spur to learning.

Although self-recitation is a form of study that prepares a pupil to meet successfully the immediate requirements of his classrooms, its usefulness becomes more evident when he reaches high-school and college levels. Many college students after using this study method ask why they were not trained to form and answer questions in a similar manner while they were in grade school.

Many failures in college have been found to be the result, not of lack of mental ability, but of neglect by teachers to present the simple principles of effective study. Training, it is agreed, should be started early in preparatory school work so that by the time high school is reached the pupils have not only grasped the principles but can apply them successfully. Educators no longer believe that this kind of training should be given only to the poor student. They are of the opinion that every student should be given the benefit of courses in this important art.

In most lines of endeavor, people who show unusual skill began training themselves early. Persistent and intelligent effort has produced from their first awkward attempts the skilled activities which we admire. They reap the rewards of carefully planned study. (*See also* Learning; Memory.)

STURGEON. Caviar and one of the best sorts of isinglass are two valuable contributions of the sturgeon to man. The former is prepared from the eggs (roe), which the female lays by the millions; and the latter is made from the inner membrane of the fish's swim-bladder. The flesh, though sometimes eaten fresh, makes much better food when smoked.

The sturgeon is a large bulky fish with a long body, a skin covered with five rows of large bony plates, and a conical and tapering snout. There are about 25 species, which vary greatly in size. Specimens 8 to 11 feet long are by no means rare, while one species of the Black and Caspian seas reaches the enormous length of 24 feet and a weight of 2,000 pounds. On the other hand, some are rather small, such as the sterlet, which rarely exceeds a length of 3 feet. Most species live in the sea a great part of the year, ascending rivers to spawn, though a few, such as the sturgeon of the American Great Lakes, are exclusively confined to fresh water. Sturgeon are found only in the Northern Hemisphere and occur in greatest abundance in southern Russia, where the fisheries are of immense value. In the United States the chief fisheries are in the Delaware River and the Great Lakes. Most sturgeon belong to the genus *Acipenser*.

STUYVESANT (*stī'vě-sănt*), PETER (1592–1672). "A tough, sturdy, valiant, weather-beaten, mettlesome, obstinate, leathern-sided, lion-hearted, generous-spirited old governor"—this is the description given by Washington Irving in his 'Knickerbocker's History of New York' of Peter Stuyvesant, the last Dutch governor of New York—or "New Amsterdam," as it was then called.

Stuyvesant had served in the West Indies as governor of one of the islands, and for his good services there was appointed, in 1647, by the Dutch West India Company as the governor of their colony of

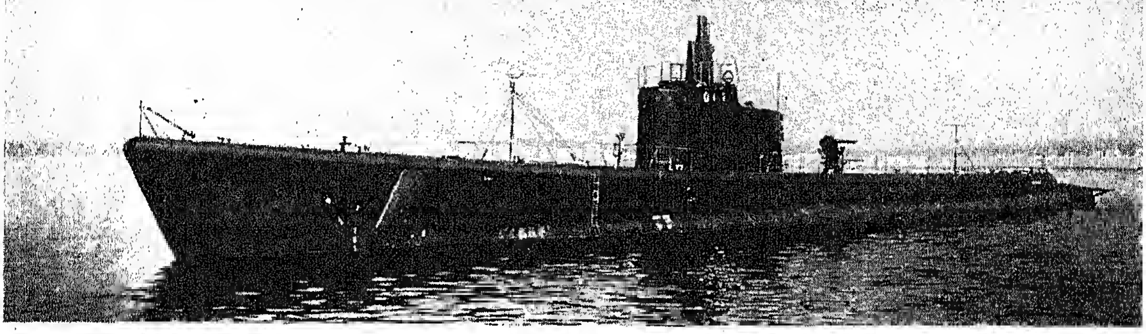
New Amsterdam. He had lost a leg in the service of the company in the West Indies, but his wooden leg has done more to preserve his fame in history than any other one thing. According to tradition, when the assembly of New Amsterdam went contrary to his wishes, he would stamp his wooden leg and roar at them.

Stuyvesant brought to his work a determination to be "as a father over his children," and he immediately set about trying to reform abuses with a commendable enthusiasm. His despotic character and his blunt manners, coupled with his efforts at reform, soon made him many enemies. He tried to regulate the sale of liquor, and forbade its being sold to the Indians at any time, but his orders were disregarded. He attempted to regulate the fur trade so as to give the inhabitants of New Amsterdam a monopoly of it, but smuggling became prevalent. His severity in punishing those who would not conform to the Dutch Reformed church, and his refusal to allow the people a share in the government, increased the hatred which most of the settlers felt toward him.

As a result of this trouble, when war arose between England and Holland and English warships appeared in New York harbor in 1664, although the city was defended by a stone fort and 20 cannon, the people refused to resist the invaders. So Stuyvesant was forced to surrender the town to the English, and New Amsterdam became New York.

Stuyvesant returned to Holland, but when the Dutch West India Company blamed him for all of their misfortunes in the New World he returned to America and spent the rest of his life on his farm, or "bouwerie," as it was called in Dutch. On the site of this farm now runs the street called after it the "Bowery," on the lower east side.

DEADLY CRAFT *that* TRAVEL UNDER *the* SEA



SUBMARINE. For more than half a century delighted boys have followed the thrilling exploits of Captain Nemo in Jules Verne's 'Twenty Thousand Leagues under the Sea'. Overshadowed by this gorgeous fiction, the occasional attempts at producing a boat which could actually travel under water seemed trivial and tame.

Then came the first World War. With the sinking of the British cruisers *Hogue*, *Cressy*, and *Aboukir*, in September 1914 by a German U-boat, the world realized that submarines would be a powerful force in naval warfare. (The term U-boat was from the German word for a submarine, *unterseeboot.*) Before the war ended, German U-boats had come dangerously near winning the war by sinking merchant shipping (*see* World War of 1914–1918).

After the second World War broke out in September 1939, Germany again made effective use of this terrible weapon, sinking millions of tons of merchant shipping, both neutral and belligerent. During the intervening years the submarine had been very greatly improved. The war submarine of 1918 had a surface speed of about 19 miles an hour, and a displacement of from 128 tons for the smallest coast-defense type to 2,160 tons for the largest cruiser or seagoing type. It had as many as four torpedo tubes and guns as large as 5.9 inches; one large mine-layer held 42 mines.

It is difficult to state exactly the sizes and capacities of modern submarines, because all governments seek to keep these details secret. But the French were known to have built a submarine 361 feet long, with a displacement, when submerged, of 4,304 tons. It carried two 8-inch guns. Submarines of about 2,000 tons have become common; those of 800 tons are now considered small. Some submarines have a surface speed of 25 miles an hour and can travel 15,000 miles or more without refueling. Some can descend deeper than 400 feet. Some can stay submerged for 60 hours at a time.

What a Submarine Looks Like

The advantage of the submarine lies in its ability to fight when conditions are in its favor, and to scuttle away unseen when they are not. It is a cigar-shaped craft, with a little hump of a conning tower and bridge on top, a signal mast, and usually two periscopes. The hull is double, the space between being used for fuel and ballast tanks, which help to protect the inner hull against shells, torpedoes, ramming, and other hazards.

On the surface most submarines are driven by internal combustion (Diesel) engines burning heavy

oil, for gasoline fumes are too dangerous in the confined spaces of the hull. But this admirable engine cannot be used when the vessel is submerged, because of the vast amount of air required for its consumption. Below the surface, an electric engine, which needs no air to breathe, is used instead. The batteries in recent types are charged by the Diesel engine while at the surface. One reason that the submarine cannot run under water for an indefinite time is that it must come to the surface to recharge the batteries. It is said the German U-boats did not average three hours a day below the surface. Some modern submarines have four Diesel engines, two being used for moderate speed, all four for high speed. These are designed to accompany a fleet at sea, and must therefore be able to go as fast as the fastest battleship.

The submarine dives by letting sea water into the ballast tanks; it rises by blowing the water out of the tanks with compressed air, stored in seamless steel flasks at pressures of 1,000 and 2,500 pounds a square inch. The distribution of these water-ballast tanks, so that the boat will run on an even keel, whether submerged, awash (that is, with only the conning tower exposed), or on the surface, is exceedingly important. The German U-boats, besides the ballast tanks between the two hulls, had two other ballast tanks amidships. The fuel-oil tanks had holes in the bottom to admit water as the oil was used up. The heavy lead keel could be dropped off in case of accident beneath the water, to bring the boat to the surface.

How the Submarine Keeps at a Given Depth

In order to remain at any given depth, the submarine must keep moving; it cannot hang suspended and motionless between the waves and the sand. To run below the surface, it usually takes on just enough ballast to leave it a little lighter than the water it displaces, and then runs with its horizontal rudders or hydroplanes tilted to hold it down. If its engines should break down under water, it must go to the bottom or to the top. If an enemy is hovering near, it may be preferable to drop down to the bottom and lie quiet—that is, unless the water is so deep that the pressure would crush the fragile hull.

To withstand the pressure of the water at the depths to which it may venture, the inner hull of the vessel is circular and very heavy and strong. As the outer hull has no air spaces, the pressure is the same within and without. It is therefore made of lighter material and so shaped as to keep the vessel steady when running on the surface.

The steersman may stand on the bridge when the vessel is running on the surface; in the conning tower, with its thick glass sighting ports, when slightly submerged or when seas are high; or in the central station or operating compartment down in the depths of the craft, viewing the surface only through the periscope, when submerged. There are usually at least two periscopes; this provides against accident and permits steersman and commander to use them at the same time.

The periscope tube, about 6 inches in diameter, stands about 30 feet above the top of the conning tower. It can turn in any direction, and is sometimes used to give a wider range of vision when the vessel is on the surface. The little tube itself is inconspicuous enough when the vessel is submerged, but it leaves a very suspicious-looking wake behind it. To run blind and then bob up for a view might mean a collision; so periscopes have been devised with a reduced diameter of two or three inches at the upper end, and also collapsing periscopes, which can be raised by a hand lever for a moment's view and then dropped down out of sight. (*See* Periscope.)

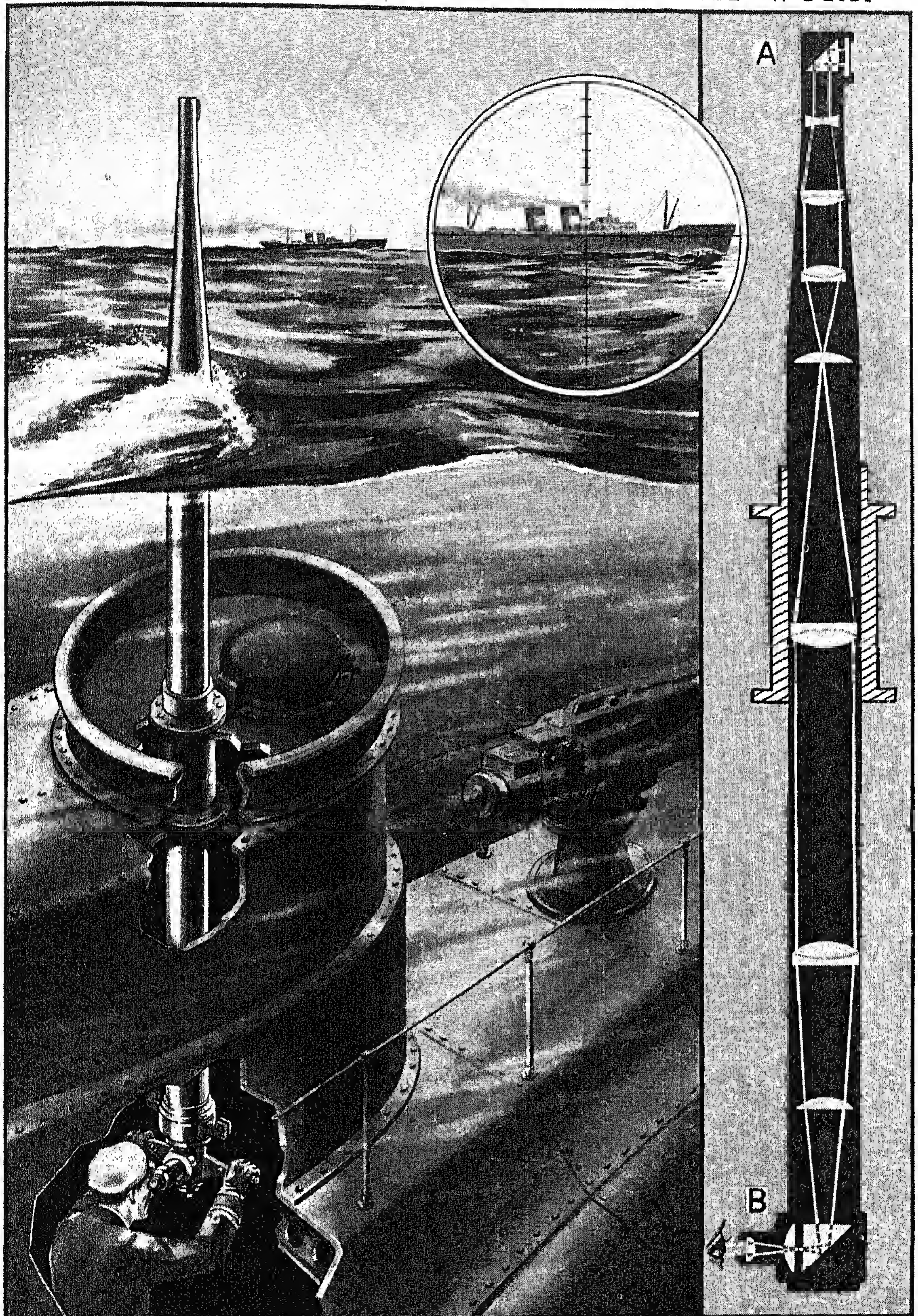
No Six-Footers Wanted

Living quarters are installed forward in the boat, one large submarine having 7 officers and 84 men, another having 121 men all told. Ventilation systems have much improved. All this, with auxiliary machinery, crowds the little hull almost to bursting. Small men are therefore preferred for submarine duty during a war. What with the cold, the heat, the stifling air when submerged, the whole cramped unnatural life—not to speak of the nerve-racking terrors when the submarine becomes the hunted instead of the hunter—existence on board an undersea vessel is not exactly ideal.

Captain Nemo's favorite amusement was ramming his enemies. A few submarines were sunk by being rammed by others during the war, but guns and torpedoes are the submarine's real weapons, with guns for choice if the enemy is unarmed. In order to use its guns, however, a submarine must present itself as target, with excellent chances of being sent below if the adversary is armed. Torpedoes, on the other hand, cost thousands of dollars, and it would be shocking extravagance to use one on a vessel known to be unarmed, or one so far away that there is no certainty of hitting it. In the World War of 1914–1918 German U-boats had orders not to fire torpedoes at ranges of more than 300 yards unless conditions were favorable; but much greater ranges have become practical since that time. A submarine usually carries two torpedoes for each tube, one in position to fire and one extra. The torpedoes are fired by compressed air or by an explosive (*see* Torpedoes and Mines).

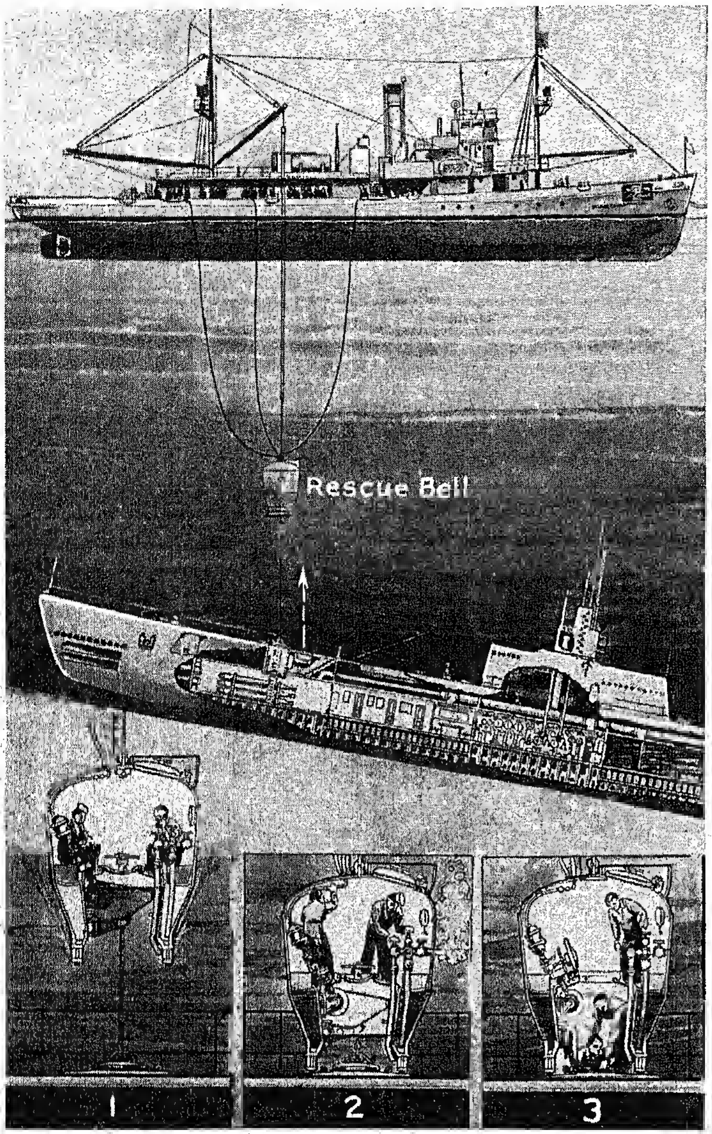
In 1914–18 the Germans expected to weaken the British and French fleets by sinking the vessels one by one with torpedoes, until the German fleet could give battle to its foes on fairly even terms. The U-boats never materially weakened the Allied fleets, however, because they could not penetrate the screen of destroyers which always surrounded the fighting vessels. Destroyers afforded splendid protection because their heavier gun power could win any fight on the surface, and their speed and lack of height made them difficult targets for torpedoes except in a calm sea. Their speed and maneuverability also gave them a good chance to dodge a torpedo if fired, and when

THE PERISCOPE OF A SUBMARINE AT WORK



The observer points the periscope toward a ship on the horizon. What he sees is shown in the circle against a telemeter scale that gauges distance. At the right we see how the light rays enter the periscope and are turned downward by a prism (A). They pass through a telescopic system of lenses, then are turned outward through the eyepiece by a second prism (B).

RESCUING MEN FROM A SUNKEN SUBMARINE



Above, a rescue bell is going down to a disabled submarine. The bell is equipped with air intake line, exhaust line, hoisting cable, and telephone and power lines. A diver has moored it to the submarine's escape hatch. Below are shown three successive steps in the rescue. (1) The bell is drawn down by reeling in the mooring cable with a motor-operated winch. (2) When the bell settles into place over the escape hatch, the water above the hatch is drawn into tanks in the side of the bell. (3) The bell's trap door and the escape hatch can now be opened, and the rescued men enter the bell. Then the trap door is closed, the water is forced out of the tanks, and the bell rises to the surface. The picture at the right shows the device called a "lung," used for escaping from a submarine without help from above. The wearer's nose is closed by a clip, and he breathes oxygen and air through a mouthpiece gripped in his teeth. To avoid too sudden a change of pressure, he climbs slowly up a rope which has been carried to the surface by a float from the submarine's escape hatch.

they were lightly loaded a torpedo might well pass under the hull without doing damage.

To fight submerged submarines, destroyers use depth bombs, or "ashcans." These are dropped where a submarine is supposed to be, and the fuses are set to explode them at various depths. The force of the explosions damages or crushes the hull of any submarine in the vicinity.

To detect submerged submarines, navies use listening devices called *hydrophones* and *supersonic detectors*. Hydrophones are installed under water on each side of a ship. The one nearer the submarine hears the sound more strongly. The adjustment needed to make the two sounds equal reveals the direction of the submarine. A supersonic detector sends sound waves of high frequency through the water in all directions. Any near-by submarine reflects the waves back. The time taken for them to return reveals the distance. Submarines also use these devices for detecting surface ships, and even for aiming torpedoes without raising a periscope.

Merchant ships are protected by gathering them into convoys, surrounded by destroyers. Another defensive device is the Q-ship. Disguised as a merchant vessel, it lures a submarine to the surface, and then opens fire with its masked guns.

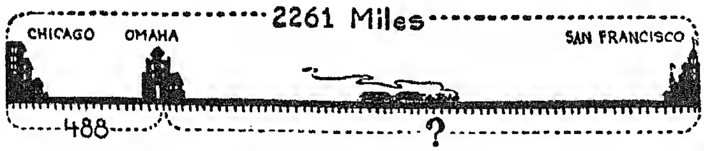
Invention of the Submarine

A Dutchman, Cornelius van Drebbel, is said to have invented a craft which was rowed beneath the surface of the Thames in 1620. David Bushnell's *Turtle* was used in 1776 in an unsuccessful attempt to blow up a British warship in New York harbor. Robert Fulton built a submarine and used it to blow up targets in demonstrations before Napoleon and the British prime minister Pitt. But they showed no interest, and neither did the United States. The first success scored by a submarine came when the Confederate craft *Hundley* blew up the U.S.S. *Housatonic* in Charleston harbor Feb. 17, 1864, and was itself destroyed.

All these earlier submarines lacked proper propelling machinery. John P. Holland overcame this defect by using a gasoline motor on the surface and electric machinery under water, when he built the *Holland No. 9* for the United States Navy in 1898. Simon Lake also built submarines at this time.

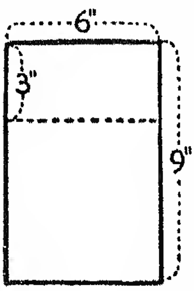
The German merchant submarine *Deutschland* proved the possibility of submarine blockade running by visiting the United States twice in 1916.

PRACTICAL HELPS *in Learning* SUBTRACTION



SUBTRACTION. Suppose we wish to know the distance from Omaha to San Francisco. We find that Omaha is 488 miles from Chicago by railroad, while San Francisco is 2,261 miles from Chicago. The solution of this problem means that we must compare these two distances with a view to finding the *difference* between them; or, looking at it in another way, of finding how much greater 2,261 is than 488. To help us solve this rather difficult problem, let us first consider some simpler examples.

1. If a sheet of paper is 6 inches wide and 9 inches long, how may it be cut to make it square? Since we know from our study of addition that 9=6+3, we cut off 3 inches from the longer side. When we place a 6-inch line beside a 9-inch line we find that 3 inches must be added to the 6-inch line to make it 9 inches long, or that 3 inches must be taken from the 9-inch line to make it equal to the 6-inch line. In other words, 3 is the *difference* between 6 and 9.



2. One basket of grapes weighs 9 pounds, another 14 pounds. How much more does the heavier one weigh? 5 pounds is the *difference* in weight.

3. It is 10 o'clock. How many more hours to 12 o'clock? 2 hours is the *difference* in time.

In the paper problem above, the difference can be measured directly. In the weight and time problems that follow it, the difference can be found by counting from 9 up to 14 or from 10 up to 12, as the case may be, e. g.—10, 11, 12, 13, 14 (5 numbers counted, then 14 is 5 greater than 9). Differences, however, need not be counted if the *addition* facts are known. For example, since 9+5=14, when 9 is given it follows that to make 14, 5 more are needed.

100 SUBTRACTION FACTS

0 0 0	1 0 1	2 0 2	3 0 3	4 0 4	5 0 5	6 0 6	7 0 7	8 0 8	9 0 9
1 1 0	2 1 1	3 1 2	4 1 3	5 1 4	6 1 5	7 1 6	8 1 7	9 1 8	10 1 9
2 2 0	3 2 1	4 2 2	5 2 3	6 2 4	7 2 5	8 2 6	9 2 7	10 2 8	11 2 9
3 3 0	4 3 1	5 3 2	6 3 3	7 3 4	8 3 5	9 3 6	10 3 7	11 3 8	12 3 9
4 4 0	5 4 1	6 4 2	7 4 3	8 4 4	9 4 5	10 4 6	11 4 7	12 4 8	13 4 9
5 5 0	6 5 1	7 5 2	8 5 3	9 5 4	10 5 5	11 5 6	12 5 7	13 5 8	14 5 9
6 6 0	7 6 1	8 6 2	9 6 3	10 6 4	11 6 5	12 6 6	13 6 7	14 6 8	15 6 9
7 7 0	8 7 1	9 7 2	10 7 3	11 7 4	12 7 5	13 7 6	14 7 7	15 7 8	16 7 9
8 8 0	9 8 1	10 8 2	11 8 3	12 8 4	13 8 5	14 8 6	15 8 7	16 8 8	17 8 9
9 9 0	10 9 1	11 9 2	12 9 3	13 9 4	14 9 5	15 9 6	16 9 7	17 9 8	18 9 9

The 100 Fundamental Facts (Combinations) in Subtraction of Integers.

Remainders

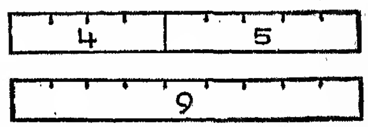
4. If from a rope 15 feet long a piece 8 feet long is cut, how much rope remains?

Solution: Here we may count the numbers from 8 to 15 and find that there are 7 of them. Hence the *remainder* is 7 feet A better way is to remember that if 8 is one of the two numbers whose sum is 15, the other is 7. It is clear that a remainder left after taking away part of a number is found just as an excess or a difference in value is found between two numbers.

5. Henry had 17 marbles and lost 9. How many had he left? We may count from 9 up to 17 and conclude that Henry had 8 marbles left; or we may set out 17 counters, then remove or subtract 9 of them and count the number left. The latter is the traditional notion of subtraction. The first method of ascertaining remainders by counting up (the "additive" method) seems to be simpler than the "taking away" or "straight" method, and is consequently adopted for further treatment of this subject.

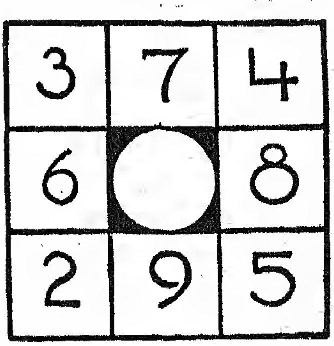
To compute *differences* or *remainders*, it is necessary to know the 100 fundamental subtraction facts or combinations shown in the table in the center of the page. A similar table of 100 fundamental facts in addition will be found in the article on Addition.

These fundamental subtraction facts must become thoroughly familiar, but they should require little practise if the addition facts are well committed. Since 4+5=9, then



it follows as a consequence that 9−5=4; also 9−4=5. If 4 and 5 put together make 9, then when either is wanting the other is needed to make 9.

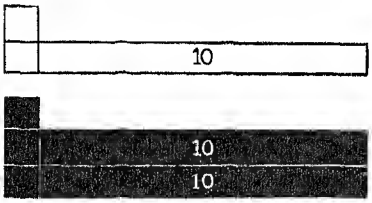
Here is a drill chart. Draw it upon a blackboard or on a large sheet of paper, put in the center as minuend some number between 10 and 20, and give quickly the difference or remainder as the other numbers are pointed to. Change the minuend frequently.

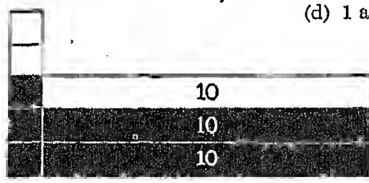


Computing

Cut strips of paper 10 inches long and 1 inch wide for the tens and squares 1 inch long for the ones.

1. How much more than 23 is 35?





Solution:
(a) 3 and what make 5? (Set down the 2.)
(b) 2 tens and what make 3 tens? (Set down the 1 ten.)
(c) Then 23 and what make 35?

35
23
12

2. What is the difference between 43 and 75?

Solution:
(a) 3 and what = 5? (Set down the 2.)
(b) 4 tens and what = 7 tens? (Set down the 3 tens.)
(c) Then 43 and what make 75?

75
43
32

3. Find the remainder when 43 is taken from 68.

(a) 3 and what number make 8?
(b) 4 tens and how many make 6 tens?
(c) Then 43 and what make 68?

68
43
25

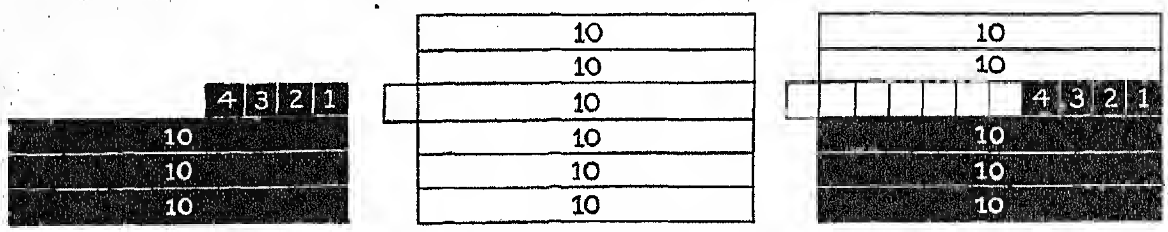
4. 61 is how many more than 34? To understand the solution better, look at this addition:

34
27
61

Omit the lower number, but keep the sum.

34
+ what
= 61?

11 must have been the sum of the first column. Why? Then what was the missing figure under the 4? 4 and



what make 11? When the 1 was set down, 1 was also carried to the tens column. What was the missing figure under the 3? 4 tens and what = 6 tens? Then what was the missing number?

Solution:
(a) Since 4 is greater than 1, we count up from 4 to 10 and then 1 more. 4 and what=11? (*See* the figure above.) Set down the 1. Carry 1 ten to 3 tens.
(b) 4 tens and how many=6 tens?
(c) Then 34 and what=61?

61
34
27

Answer: The difference is 27.

We may now solve the problem we asked at the beginning, about the distance between Omaha and San Francisco. We know that Omaha is 488 miles from Chicago, and that San Francisco is 2,261 miles from Chicago. To find the distance between Omaha and San Francisco we subtract the former number from the latter, working the problem out in this way.

Solution:
(a) 8 and what number=11? (Set down 3. Carry 1 to the 8 tens.)
(b) 9 and what=16? (Set down 7. Carry 1 to the 4.)
(c) 5 and what=12? (Set down 7. Carry 1 to the vacant place.)
(d) 1 and what=2? (Set down 1.)

2,261
488
1,773

Answer: The distance is 1,773 miles from Omaha to San Francisco, because the latter place is 1,773 miles farther from Chicago.

Terms Used in Subtraction

In a subtraction problem, the number *diminished* or the greater of the two numbers compared is called the *minuend;* the number subtracted or the lesser number of the two compared is called the *subtrahend;* the number left after subtraction is called the *remainder;* the number by which the greater exceeds the less is called the *difference.*

864	*minuend*
218	*subtrahend*
646	*remainder* or *difference*

Checks or Tests

1. Add the subtrahend and remainder or difference. If the work is correct, the sum equals the minuend.

864	*minuend*
218	*subtrahend*
646	*difference*
864	*minuend*

2. Subtract the difference from the minuend. The result should be the subtrahend.

864	*minuend*
646	*difference*
218	*subtrahend*

Accuracy and speed in subtraction are secured by these things: (1) by mastering the "fundamental facts"; (2) by using as few words as possible in computing; (3) by forming the habit of testing the correctness of each answer.

Problems for Practice

Find the difference:

1. 876−324=?
2. 968−453=?
3. 694−427=?
4. 786−329=?
5. 5,344−2,788=?
6. 4,213−3,679=?
7. 50−31=?
8. 400−224=?
9. 7,000−2,132=?
10. 10,000−4,654=?
11. 962−47=?
12. 875−39=?
13. 7,832−456=?
14. 3,010−2,703=?
15. 40,060−3,245=?
16. 400,200−346,132=?
17. 1,687−499=?
18. 529−372=?
19. 93−57=?
20. 392−28=?
21. 880−257=?
22. 84−35=?
23. 5,643−2,326=?
24. 1,400−826=?
25. 3,008−573=?
26. 5,280−4,913=?
27. 6,973−3,010=?
28. 1,771−785=?

ENGLAND'S FAMOUS CAMEL CORPS THAT POLICES THE SUDAN

Some 1,100 picked men, mounted on racing camels, make up the famous Camel Corps maintained by the British government to keep order in the English Sudan. Trained to resist hardship and thirst, these men ride their camels at such a pace that they are obliged to bind their bodies tightly to endure the terrific jolting, as these swift animals are able to travel 100 miles in a day. The first Egyptian Camel Corps was organized to go to the relief of "Chinese" Gordon, who was besieged at Khartum in 1884.

SUDAN. The region in central Africa stretching south of the Sahara Desert to the maritime countries of the west coast and the basin of the Congo, and from Cape Verde on the Atlantic coast to the Red Sea and the Ethiopian and Galla highlands on the east, is called "the Sudan," the full name being *Beled-es-Sudan*, an Arab term meaning "country of the blacks." It has an area of more than 2,000,000 square miles and a population (chiefly negro and a few Arabs) estimated at between 10 and 20 million.

Egypt ruled over most of the Sudan for about 60 years prior to 1882; then Mohammed Ahmed of Dongola, proclaiming himself the Mahdi (the long-looked-for redeemer of Islam), led a revolt against Egyptian domination. (*See* Gordon, Gen. Charles George.) From 1885, for about 13 years, the Mahdi and his successor, the Khalifa, held the country by ruling as tyrants. In 1898 the Khalifa was overthrown by a combined British and Egyptian army under the command of General Kitchener. (*See* Kitchener of Khartum, Earl.) The following year Egypt and Great Britain signed a treaty providing for the administration of the territory as a condominium; that is, the two governments rule jointly. Egypt appoints a governor-general with the assent of Great Britain, and their flags are shown together. This status was reaffirmed in the Anglo-Egyptian Treaty of 1936. Khartum is the capital. (*See also* Egypt.)

The western and central portions of the Sudan are divided into a number of native states, virtually all of which are under French or British control. The land ranges from steppelike plains and open forests to elevated plateaus and lofty mountains. Lake Chad, near the center, has an area varying from 10,000 square miles in the dry season to perhaps 20,000 square miles in the rainy season; it has no outlet, but its waters are fresh. The Niger River, in the west, is the greatest avenue of travel, being navigable by small steamers for more than 1,200 miles, to Timbuktu—the center of the caravan trade in west central Africa. The climate, animals, and products are tropical.

The Anglo-Egyptian Sudan is the chief source of the world's gum arabic and ivory, the section's principal exports. Other products include senna leaves and pods, sesame, dates, groundnuts, hides and skins, salt, and gold. The Sudan also supplies great quantities of Egyptian cotton, and in the northern provinces of Berber and Dongola, where there is irrigation, long-staple American cotton thrives. Fiber and tanning materials are obtained from the forests along the Blue Nile River, while the forests on the White Nile yield gum acacia, ebony trees, the bamboo, and the rubber creeper. In the upper reaches of the White Nile, where the sudd areas—large masses of floating vegetation—form, vast quantities of papyrus grow. Millet is the principal grain crop.

Exports of the French Sudan are the same as those of the Anglo-Egyptian Sudan, and the native industries include pottery and brick manufacture, jewelry and leather making, and weaving.

Telegraph, telephone, and wireless communications are well established in the colonies. Rail and motor transportation are developing, while steamers carry passengers and freight on the principal rivers. (*See* Africa; Egypt.)

SUEZ (*sṳ-ĕz'*) **CANAL.** The dream of a canal across the Isthmus of Suez had occupied the minds of men for ages, from the time, centuries ago, when the great pharaohs of Egypt had connected the Nile with the Red Sea. But nothing came of the dream. Ships continued to sail or steam all the way around Africa in order to reach the Mediterranean from the Red Sea. Then came a French engineer, Ferdinand de Lesseps, who got the necessary rights from his friend, Said Pasha, viceroy of Egypt, organized a company in 1858, and went to work.

On Nov. 17, 1869, the hundred-mile canal was formally opened. There were elaborate and costly ceremonies at the northern terminus, Port Said, which is named for Said Pasha. Afterward a fleet of vessels of various nationalities steamed through the canal toward the city of Suez at its southern end. The leading vessel, the French Imperial yacht *Aigle*, carried Empress Eugénie, wife of Napoleon III. At Ismailia, the midway port, Khedive Ismail Pasha entertained some 6,000 persons in his new palace (a beautiful and

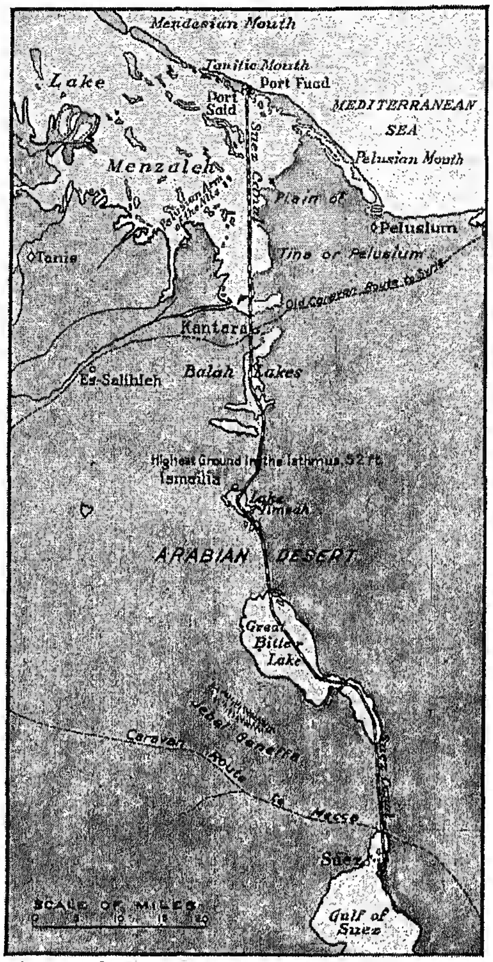
costly building that is no longer standing). On November 20 the fleet arrived at Suez.

The canal, then the longest in the world, presented little actual difficulty in its digging, except for a short distance through soft stone. It really amounted in many places to deepening a channel in lakes and lagoons already existent. The company found itself in financial difficulties many times during the progress of the work and in 1875 the khedive of Egypt decided to sell the large number of shares that he held. The English government stepped in and bought these shares, thus gaining virtual control of the company. This was one of Disraeli's boldest acts to promote his policy of imperialism (*see* Disraeli). In the early days when De Lesseps was selling shares for 500 francs each neither England, Russia, Austria, nor the United States would subscribe to the venture. The English looked with fear on the project as they felt that it would work a great hardship on English shipping. The undertaking, however, has justified itself, as the shares held by the British government, for which less than 20 million dollars was paid, have already returned more than eight times this amount in interest and earnings. Normally, more than half of the ships passing through the canal are of British registry, and the canal has been of the greatest value to British shipping.

The management of the canal is under the direction of a board of which the French have the largest number of members, so that the control is practically French, although the French government does not actually own any interest. The concession provides that the rights of the company are to expire in 1968, when the canal and all the accessories will revert to Egypt.

In both world wars the canal was of immense strategic importance and, although it had been provided by international agreement that ships of all nations should have equal rights, the canal was taken over by the military authorities of England and closed to shipping of enemy nations. For its entire length it became practically a continuous armed camp. In the second World War squadrons of German and Italian airplanes did much damage by dropping mines and bombs. The attacks were, however, less effective in blocking the canal and tying up shipping for long periods than they would have been in the previous war, because in recent years the channel has been widened and deepened.

THE CANAL FROM SUEZ TO PORT SAID



The map shows how the canal was dug so as to make use of the beds of the natural lakes. It is interesting to know that for most of the way it follows the course of a canal that is mentioned by the Greeks as having been in existence before the year 1300 B.C. This is said to have been constructed by the pharaohs of Egypt and was filled in and practically obliterated by the inundations of the Nile. The Suez Canal is an open channel and contains no locks.

The vision of De Lesseps has been more than fulfilled. The journey from London to Bombay, formerly a tedious and dangerous trip of 10,870 miles, was at once shortened to 6,307. Since 1887, ships have been permitted to steam through the canal at night as well as by day, and the average time of the passage is about 13 hours. Mail ships are given the right of way. The Suez Canal cost about 83½ million dollars and today it rivals the Panama Canal in the amount of traffic passing through it. Panama handles slightly more vessels in an average year but Suez leads slightly in freight tonnage. In an average year about 6,000 ships use the latter canal.

Since 1920 the number of American ships using the Suez Canal has dropped. In that year 152 American vessels having a net tonnage (Suez measurement) of about 724,000 tons passed through.

In 1935, by agreement with the Suez Canal Company, Egypt was given a share in the profits and management of the canal.

SUFFRAGE. "Who shall be allowed to vote?" is one of the questions which must be answered in drawing up the constitution of any self-governing organization, whether it is a society, a city or state government, or a league of nations. This privilege of voting we call *suffrage*.

Until recent years suffrage was restricted in most countries to males above the age of 21. Other requirements are usually citizenship and a certain term of residence where one votes. In the United States the suffrage is granted and controlled by the states, so there are many different requirements for the suffrage. The idea that voting is a "natural right" of mankind finds its logical conclusion in universal

adult suffrage, but in most of the United States the suffrage is restricted by the exclusion of criminals, idiots, illiterates, and sometimes other classes. A property qualification is now seldom required. Woman suffrage, the right of women to vote on the same or almost the same terms as men, spread rapidly in the 20th century, both in the Old World and the New, and in 1920 was embodied in the United States Constitution by the 19th Amendment (*see* Women's Rights).

Previous to the Civil War most of the states withheld the right to vote from negroes. By the 15th amendment to the Constitution, the states are forbidden to abridge suffrage "on account of race, color, or previous condition of servitude." Today 40 to 45 per cent of American citizens are eligible to vote, but even in presidential elections only 50 to 70 per cent of the vote is cast. There has been some agitation to make the vote compulsory, as has been tried in Belgium, Holland, Argentina, and elsewhere, but no such action has ever been taken. There also is a persistent movement to permit the public, instead of the state legislatures, to vote on amendments to the national constitution. (*See* Elections.)

The HISTORY *of a* LUMP *of* SUGAR

The Sugar Cane of India and How the Arabs Brought It to Europe—How a Taste for Sweets Helped to Discover America, and How it Played a Part in the Napoleonic Wars—A Visit to a Sugar Factory

SUGAR. It is sometimes said that Americans eat almost their own weight in sugar every year. Like other English-speaking peoples, they have an exceedingly "sweet tooth" and eat about three times as much sugar in proportion to population as the average European nation. The sugar consumption of a country is often referred to as an indication of its prosperity. The amount of sugar used in the United States is twice as great now, in proportion to population, as it was 50 years ago; and sugar is one of the largest of all imports both in tonnage and value.

Sugar is a comparatively modern product. The ancient Greeks and Romans had no sugar, and used honey instead for sweetening. Sugar was produced first in India, as early as the 1st century of our era, either from the bamboo or from sugar cane or from both; but for many centuries it was used only as a medicine or as a rare delicacy at feasts.

The Arabians, who gave Europe so many wonderful things, brought the sugar cane plant from India to the west, and also gave us its name—for the word "sugar" is Arabic. First they introduced the cultivation of the plant into the valley of the Tigris and the Euphrates, then into Egypt, and finally into Spain. It was not until the time of the Crusades (12th and 13th centuries) that sugar became generally known in Europe. The earliest record we find of sugar in England was at the beginning of the 14th century, when it was used only as a medicine. Two pounds of it cost as much as a pig, or as much as a carpenter could earn in 10 days.

How Sugar Helped Discover America

By the close of the 14th century Europe had developed a flourishing trade in sugar and other Oriental products by the overland route. Venice remained the great central market of this trade until the beginning of the 15th century, when Vasco da Gama made his memorable voyage around the south of Africa and discovered a water route to India. Columbus too was seeking a water route for the trade in sugar and spices when he discovered the New World.

Soon successful efforts were made to grow sugar nearer home. From Madeira and the Canary Islands the sugar cane was introduced into Haiti, Cuba, and other islands of the western Atlantic, and then into Mexico and Brazil. The sugar and spice trade was immensely valuable, and one of the great motives which impelled Spain, France, England, and other European nations to reach out after tropical and subtropical colonies was to obtain a sugar supply. Sugar cane was first grown in the English colonies in North America in 1751, but the industry was of no importance until about 75 years later.

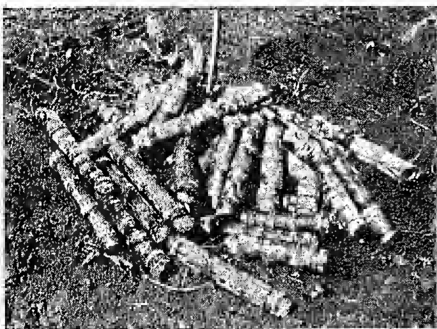
Introduction of the Sugar Beet

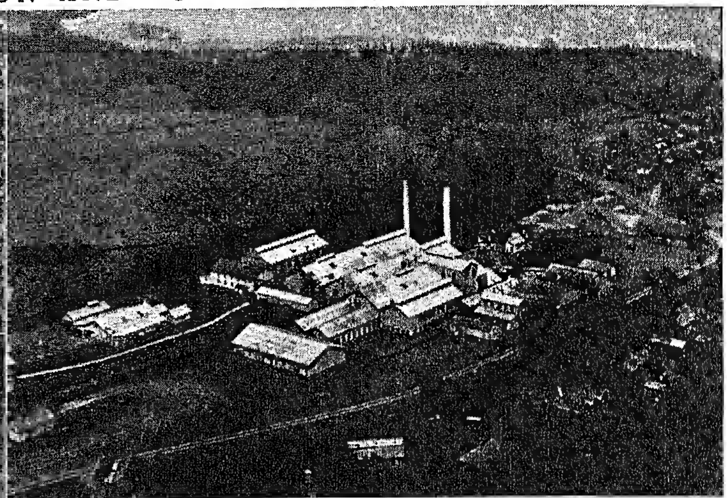
Up to the time of the Napoleonic wars, at the beginning of the 19th century, practically the whole of the world's sugar supply came from the sugar cane, which grows only in tropical and subtropical lands. Today one-third of the world's sugar is produced in the temperate regions of Europe and America from the sugar beet. The first serious attempt to utilize this source of supply was made by Napoleon when the Allies were blockading the ports of continental Europe, and cut off the imports of sugar. Napoleon made large grants of land and money to encourage the sugar beet industry, and many factories were established in France and Germany. In the latter half of the 19th century the new industry advanced by leaps and bounds in Europe, but it did not become important in the United States until the final decade of the century.

Cane sugar is now produced chiefly in India, Cuba, Java, the Hawaiian and Philippine Islands, Formosa and Japan, Porto Rico, Brazil, and other warm lands. Louisiana produces most of the cane sugar grown in the United States. Georgia, Mississippi, Florida, Alabama, and Texas grow some, largely for syrup.

Beet sugar is produced chiefly in Germany, Russia, the United States, and France. The principal sugar-beet states are Colorado, California, Michigan, Montana, Nebraska, Wyoming, Idaho, Utah, and Ohio, for sugar beets grow best in rich soil, with enough

CANE PLANTATION AND SUGAR MILL IN HAWAII





The sugar cane "seeds," piled at the upper left, consist of joints cut from the tops of stalks. In each joint is a bud, or eye, which sprouts. The laborer, below, is cutting down the mature cane with a sharp, broad-bladed knife. At the right is a sugar mill, its chimneys towering over the homes of workers on one side and over the cane fields on the other. Here the juice is squeezed out of the stalks with heavy rollers and then crystallized into raw sugar for shipment to California.

moisture in spring, a dry summer, and a cool dry fall. Irrigation has changed semi-arid sections of the West into regions of large production.

Growing Sugar Cane

Sugar cane, a perennial, jointed grass, thrives in moist warm climates. The stalks of some varieties reach 24 feet. A hard rind encases the juicy pith. The juice is about 80 per cent of the weight of the cane, and contains from 10 to 20 per cent sugar. Slender leaves spring from the upper joints. A tassel at the top of the stalk signals harvest time. Sharp knives cut the cane and strip it of leaves. An acre will yield from 20 to 45 tons of stalks. At the mill, shredders and rollers squeeze out the juice. The crushed stalks, or "bagasse," emerge from the final squeezing as a pulp which is used as fuel at the mill, as a feed for cattle, or made into fiber board ("celotex") for building insulation.

From Cane Juice to Sugar

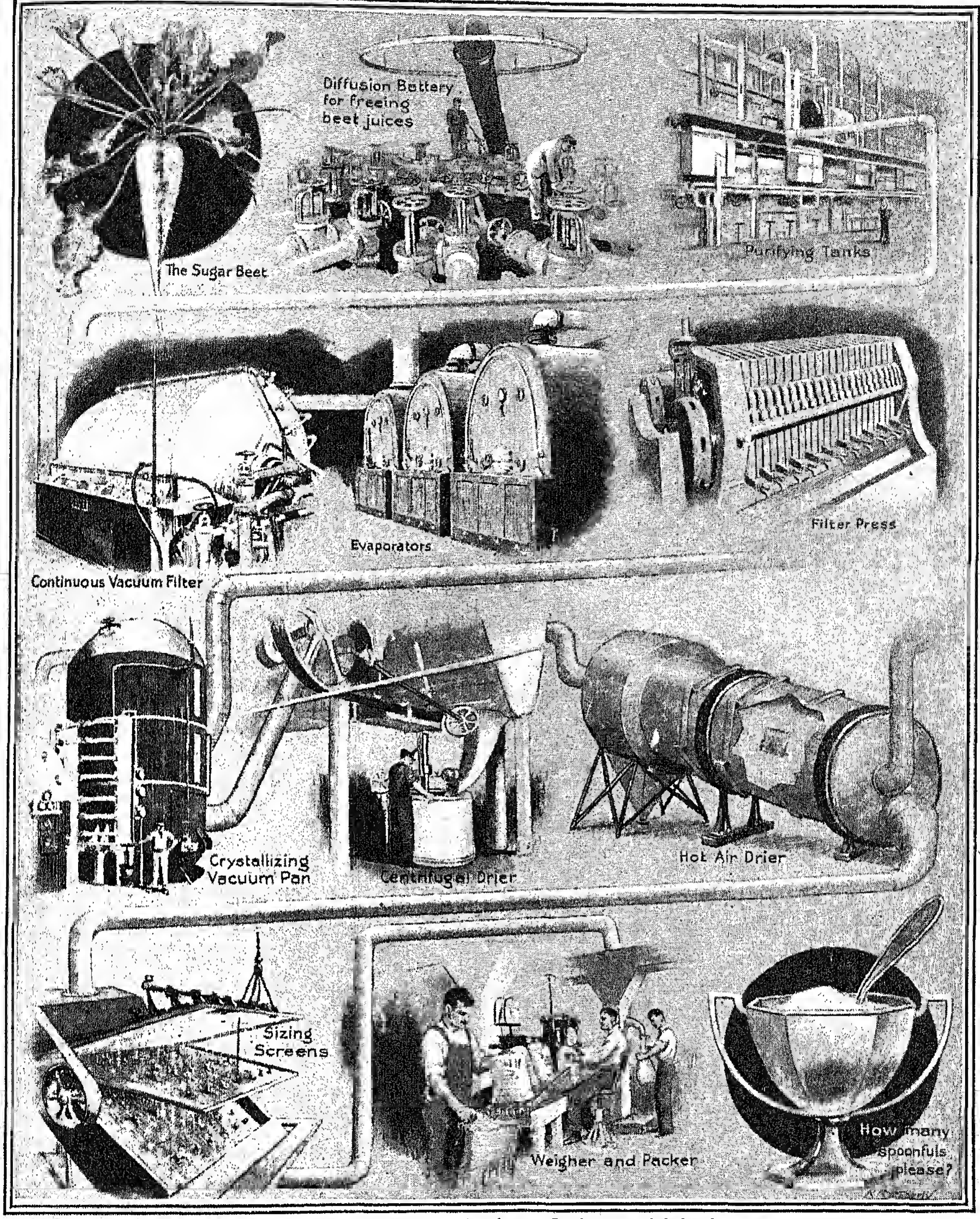
To prepare for crystallization, the raw juice—muddy and acid—must be neutralized and purified. This is done with milk of lime. Sometimes the acidity of the juice is first increased by forcing through it bubbles of sulphur dioxide gas. This makes the reaction of the juice with the lime more powerful and brings about a heavier precipitation of impurities. These are then removed by settling and filtering.

Vacuum evaporators turn the juice into a syrup. The syrup is then boiled in vacuum pans to form a brown mass ("magma") of crystals and molasses. The magma goes into "centrifugals," where most of the molasses is driven off through holes in whirling drums, leaving the sugar crystals inside. The molasses is used in making alcohol and rum, or for fertilizer, fuel, or food for cattle.

From Raw Sugar to White Sugar

The sticky crystals are called "raw sugar" or "brown sugar." To turn this into white sugar, it must be refined—that is, washed, clarified, and bleached. A near-by refinery may do this work, or the raw sugar may be packed in burlap bags and shipped to such important refining centers as Brooklyn, Philadelphia, New Orleans, or San Francisco. Here the film of dark

FROM SUGAR BEET TO SUGAR BOWL



These pictures show the process whereby we get sugar from sugar beets. In the upper left-hand corner is a sugar beet, ready to be sliced into "cossettes" and yield its juices. Next you see the top of a battery of "diffusion tanks," arranged in a circle. Each new lot of cossettes is packed into one of the tanks, and water is turned on. The water visits each of the tanks in turn, absorbs the sugar contained in the cossettes, and passes to the purifying tanks, where it is treated, first with milk of lime and then with carbonic acid gas. The lime seizes upon impurities, and the gas precipitates the lime. The liquid enters the vacuum filter, where the precipitate is removed, and goes to the evaporator, which reduces the liquid to a somewhat thick sirupy consistency. After being subjected to sulphur fumes, which bleach it, the thickened liquid passes through filter presses, and is ready for the graining process. This is conducted in huge copper cylinders called "vacuum pans." These cylinders are heated by steam coils, and an air pump maintains a partial vacuum within them, in order to permit boiling at low temperature. The heat causes the sugar to gather into crystals within the liquid. The crystals are then removed from the liquid by the centrifugal drier, the last moisture is driven out by the hot-air drier, and the sugar is graded for size, weighed, packed, and shipped.

molasses that still clings to the crystals is washed off in a centrifugal machine provided with a water spray. The crystals are then dissolved in warm water. The sugar liquor is treated with diatomaceous earth, and first filtered through cotton cloth, and finally through bone-black (animal charcoal), which also bleaches it. Boiled in vacuum pans, it granulates as white sugar. This is whirled and washed to drive off the last of the uncrystallized syrups. Sometimes bluing is added to increase whiteness. After the clean white sugar has been dried, it is packed for market.

Loaf Sugar and Cube Sugar

Until a generation ago the liquor from the vacuum pans was poured directly into conical molds about 18 inches high, where the sugar crystallized into a "sugar loaf." This was dried and wrapped in blue paper for market. Sometimes the loaves were sawed into cubes called "cut-loaf" sugar.

Today cube sugar is often made by compressing wet granulated sugar in molds the size of the lumps we use in our coffee. Cube sugar is also made by running the sugar from the vacuum pans into molds about 14 inches long, 8 inches wide, and half an inch thick; these slabs are then drained, dried, and cut into cubes. Powdered, or confectioner's, sugar is obtained by grinding the best grades of granulated sugar and sifting the powder through silk bolting cloth. The term "brown sugar" is applied to poorer grades of sugar made from molasses, as well as to unrefined sugar.

How Beet Sugar Is Made

The process of making sugar from beets is the same in principle as cane sugar manufacture, but the entire operation is conducted in one factory.

First the farmers bring their beets in wagons to the factory or to railroad receiving stations, from which they are taken to the factory. There the beets are stored in bins shaped like great troughs. They are taken from these to a washer by a current of water. Elevator buckets then carry the beets to slicing machines at the top of the building. There sharp knives on revolving disks cut them into "cossettes," or slices somewhat like shoe-string potatoes. The cossettes are packed into the "diffusion battery," a series of 10 or 12 tanks, each capable of holding from two to four tons. Warm water is forced through these cylinders, one after another, and when it is finally led off from the last tank, it contains the beet juices, as well as some impurities. These are removed by adding milk of lime and carbon dioxide gas and filtering in various types of filters.

The purified liquid is now reheated, treated with sulphur dioxide to bleach it, and filtered again. Next it goes to the evaporators, where it is concentrated to a syrup. The syrup, after treatment with sulphur dioxide and repeated filtration, goes to vacuum pans for boiling and finally to centrifugal machines, which separate the sugar from the liquid.

The syrup thrown off in the centrifugals still contains crystallizable sugar, so it is diluted, boiled, and whirled in other centrifugals. The products are brownish sugar, which goes back to the vacuum pans to become granulated sugar, and molasses.

Beet molasses is not palatable, like that from cane sugar. At many factories it is treated by the "Steffen process," a chemical treatment using finely ground lime. This recovers a large part of the sugar. Molasses not so treated is sold for cattle feed and for the manufacture of yeast and alcohol.

The beet sugar industry, which supplies from a fifth to a fourth of the nation's sugar, has several important contrasts with the cane sugar industry. Sugar cane needs little cultivation and is grown in lands where labor is cheap; the sugar beet makes heavy demands on labor, requiring deep plowing, thinning or weeding out, and constant cultivation. In the United States, where the cost of farm labor is the highest in the world, this is an important factor. Against this, sugar beets yield pulp and other by-products which are valuable as cattle feed and fertilizer. Furthermore, when sugar beets are planted in rotation with other crops, they improve the fertility of the soil.

Sugar is almost the only food that is entirely digestible. It is pure carbohydrate, and therefore pure fuel. Because it is digested rapidly, it relieves fatigue without injurious reactions. (*See* Food.)

Cane and beet sugar are chemically identical when they are highly refined. The sugar beet is not the only sugar-bearing root; others are the dahlia and the Jerusalem artichoke (a common sunflower). Nearly all ripe fruits are rich in sugar; so is the sap of many plants other than the sugar cane, notably the sugar maple (*see* Maple).

Some of the Many Sugars

Sucrose (cane or beet sugar) is the most familiar of many sweet substances called sugars. They are all composed of carbon, hydrogen, and oxygen. The last two are present in proportion of two to one, as in water (H_2O)—hence the name *carbohydrate*. Sugars are identified in chemistry by names ending in *-ose*. The common sugars fall into two classes: the monosaccharides and the disaccharides—single and double sugars, as it were, the disaccharide molecule being capable of splitting up into two monosaccharide molecules.

Our table sugar (*sucrose*) is a disaccharide ($C_{12}H_{22}O_{11}$); so are *maltose*, a sugar formed by the action of malt on starch, and *lactose* or milk sugar, which occurs in milk and some other animal fluids. Lactose is the foundation of many pills.

The most common monosaccharides are *glucose* or grape sugar, which is found in crystalline lumps in raisins (dried grapes), and *fructose* or fruit sugar, which may be used as a substitute for cane or beet sugar in the diet of diabetic patients. Commercially, the name glucose (*see* Glucose) is given to corn syrup, because the syrup owes its sweetness principally to its content of glucose.

A mixture of glucose and fructose, called "invert sugar," is found in honey and many sweet fruits. Glucose and fructose are also called *dextrose* and *levulose* because the one rotates polarized light (*see* Light) to the right and the other to the left. Fructose (levulose) is the sweetest of all sugars. The relative sweetness of the common sugars is roughly as follows: fructose, 35; invert, 25; sucrose (cane or beet), 20; glucose, 15; maltose, 6½; lactose, 3.

Xylose, a 5-carbon sugar or *pentose* made from peanut shells, cottonseed hulls, and such waste materials, probably lacks food value, but it has industrial uses. Edible sugars have 6 or 12 carbon atoms. Sugars with still more carbon atoms are called *polysaccharides*. Among them are starches, many gums and mucilages, and celluloses.

When sucrose is heated with a little water until it melts and begins to turn yellow, it forms on cooling a hard glassy mass called "barley sugar." If heated still more it partially decomposes, leaving a soluble brown material called "caramel" which is used to color food and beverages. When boiled with water containing a small quantity of acid, cane or beet sugar is "hydrolyzed" or "inverted," giving a mixture of dextrose and levulose. This mixture does not readily crystallize, and so when the housewife makes soft candy or icing for cakes, she adds a small quantity of vinegar, lemon juice, or cream of tartar to the sugar, turning some of it to "invert sugar."

Saccharin is a white powder manufactured from coal-tar. It is 300 times sweeter than cane sugar, but has little food value. It is much used commercially for sweetening candies, pastries, and preserves.

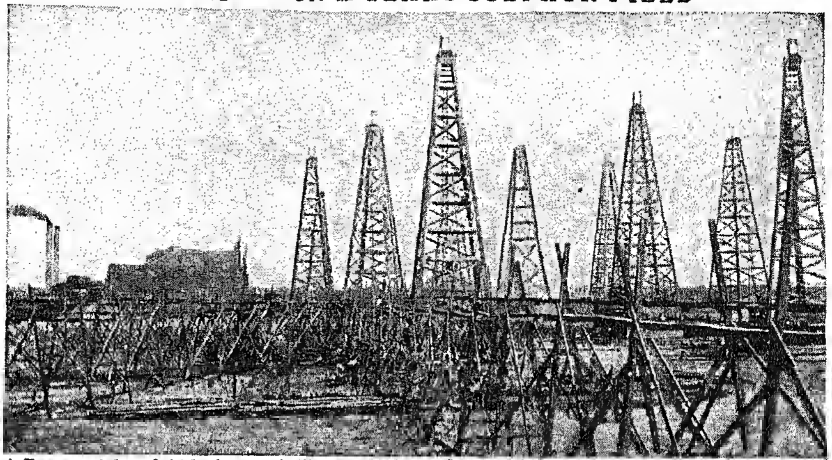
SULPHUR. Gathered from the throats of volcanoes and forming compounds that smell like the nether regions, sulphur seems like the black sheep of the family group headed by the powerful and highly respectable element oxygen. It is sometimes, indeed, a nuisance. Silver teaspoons tarnish when used with eggs because the sulphur in the egg forms a blackish silver sulphide over the surface of the spoon. That same sulphur forms an alliance with hydrogen to assault your nose with the horrible odor of rotten eggs (hydrogen sulphide or sulphuretted hydrogen). The pungent and to some people scarcely less objectionable odor of cabbage, onions, turnips, and mustard is due to sulphur compounds. Burning matches, because of the burning sulphur they contain, give off a suffocating fume of sulphur dioxide which rasps the throats of people and blackens the surfaces of metals. A very little sulphur makes iron brittle, and the sulphur from a sulphur-containing coal will attack and ruin grates and boilers.

Sulphur gets into mischief because it is an exceedingly active substance. But its activities are so varied, useful, and indeed indispensable to us that we can afford to overlook its peccadilloes. Modern industry could scarcely "carry on" without sulphur and its compounds, particularly one invaluable acid (*see* Sulphuric Acid). Sulphur enters into most of the proteins, those remarkable complex substances which are so important in animal tissues and in many vegetable structures. Human hair contains the exceptionally high proportion of 5 per cent sulphur.

Because it burns so easily, the ancient popular name of sulphur is "brimstone" or "brennestone"—that is, "burnstone." For the same reason the alchemists regarded it as the principle of combustibility and we use it in matches and gunpowder.

It occurs free in volcanic regions all over the earth and still more widely diffused in compounds. The world's commercial supply used to come almost entirely from Sicily, but now the United States is the chief producer. Nearly all American sulphur has come from the Texas-Louisiana deposits, which occur in rock formations overlying salt domes.

DERRICKS IN A TEXAS SULPHUR FIELD



A Texas sulphur field looks much like a petroleum field, with its many derricks. The wells are drilled with the same sort of rotary rig used in drilling for oil.

These deposits lie buried under from 500 to 1500 feet of soft material—clay, shale, sand, and gravel—and at first they might as well have been in the moon; all attempts to mine them failed for nearly half a century after their discovery.

Since 1903 they have been successfully mined by an ingenious process invented by Herman Frasch, a petroleum expert. Several steel pipes, of sizes ranging from 13 inches to 1 inch in diameter, are driven, one within the other, deep into the sulphur bed. Water, heated far above the boiling point, is pumped down the outer pipes. Melted sulphur, heavier than water, collects in a pool around the lower end of the pipes. Air, compressed to a pressure of about 250 pounds to the square inch, is forced down the central 1-inch pipe, and the melted sulphur, more than 99 per cent pure, rises to the surface through the next encircling pipe.

"Dr. Jekyll and Mr. Hyde" was a simple proposition compared to the multiplex personality of sulphur, which assumes at least six well-known disguises or "allotropic modifications," and some others which are in doubt as being possibly not pure sulphur. It crystallizes in two forms, the rhombic (ordinary form) and monoclinic; it has several amorphous (shapeless or non-crystalline) states, some soluble and some insoluble.

Sulphur is a non-metallic element, with an atomic weight of 32. The symbol is S. It melts at 235° F. (113° C.); you see why the water used in mining it has to be heated *above* the boiling point. When melted it becomes a clear yellow liquid, but as the temperature is further raised it darkens and thickens, until about 256° F. (180° C.) it is too solid to be poured; heated still further, it liquefies again, reaching the boiling point at 832° F. (444° C.)

It is sold in several forms: as a light yellow odorless and tasteless powder called simply "sulphur"; in solid rolls or cones, known as "roll sulphur" or "roll brimstone"; and in very finely powdered forms, one, known as "flowers of sulphur" or "sublimed sulphur," obtained by cooling sulphur vapors in a large room so that they condense and "snow down" in fine crystals, and another, known as "milk of sulphur," "lac sulphuris," or "precipitated sulphur," obtained by precipitation from solution. "Roll brimstone" is sometimes burned in old buildings to kill vermin; pets, jewelry, silverware—everything which could be injured by sulphur dioxide fumes—must first be removed, and then the doors, windows, and all crevices tightly sealed while the sulphur burns. Precipitated sulphur and sublimed sulphur are used in medicine.

Among the more important sulphur compounds, apart from sulphuric acid, are sulphur dioxide (SO_2), bleach and insecticide; the poisonous and explosive liquid carbon disulphide (CS_2), solvent, disinfectant, and insecticide; ferrous sulphate (green vitriol or copperas), mordant for dyes, insecticide, water purifier, used in the manufacture of inks and pigments; copper sulphate (blue vitriol), mordant and germicide; sodium thiosulphate, commercially known as hyposulphite of soda, used in photography, tanning, dyeing and bleaching; and the alums, complex double sulphates, used in dyeing, paper-making, and tanning, and generally as astringents. Of the sulphur compounds occurring in nature, some are valuable ores, as cinnabar (mercuric sulphide) and galena (lead sulphide); iron pyrites or "fool's gold" (iron disulphide) is sometimes used as a source of sulphur.

SULPHURIC ACID. Like the heroine of some old folk-tale, who finds her bread baked, her floor swept, and her flax spun by unseen hands, we—that is, civilized people—are served by innumerable helpers whom we may never see. One of the busiest of these unseen servitors is sulphuric acid.

From the time we get up in the morning to put on clothes dyed and bleached by the aid of sulphuric acid, until we are lighted to our beds at night by electricity conducted over wires of copper which have been refined by the aid of sulphuric acid, we are constantly depending on this powerful and active servant. The bristles in our hairbrushes were treated with sulphuric acid. It probably entered into the manufacture of the paper on which and the ink with which this book is printed. The gasoline in our automobiles may owe its purity to treatment with sulphuric acid. The very bread on our tables may be made from wheat grown with fertilizer produced from phosphate rock by treatment with sulphuric acid.

We find industrial processes which do not directly involve sulphuric acid, and we may think that in these we have escaped the general dependence; but even here, if we follow the trail far enough, we are likely to find that the material or the tools or machinery required sulphuric acid in their production. As Ellwood Hendrick says in 'Everyman's Chemistry', "We can neither go to war and have smokeless powder nor can we live in peace without it. Wherever you go in civilization you cannot get out of its path. You may never see it, you may not know its qualities and its very remarkable chemical personality, and you had better not touch it, but almost invariably it has been around before you." It has even been said that the wealth and prosperity of a people can be estimated by their consumption of sulphuric acid.

A Violent Chemical

Sulphuric acid is never satisfied, chemically speaking, with things as they are; it must always tear other compounds apart and make new ones by combining with them. In doing so it chars paper, cloth, and wood, eats into flesh, acts as a violent poison, and is generally dangerous and destructive. It is a good servant, though a bad master; the same qualities which are so dangerous uncontrolled make it invaluable when we want to break up a refractory chemical compound and rebuild it into something else. Sulphuric acid (H_2SO_4) is, for instance, the main reagent in the Leblanc soda process for splitting sodium chloride or common salt into sodium and chlorine so that soda or sodium carbonate may be made from the one and hydrochloric acid from the other; and, whatever may happen to the historic Leblanc process, sulphuric acid and soda remain the founders and regents of the realm of industrial chemistry (*see* Sodium).

The old name of sulphuric acid, "oil of vitriol," is now strictly applied only to the 93.5 per cent acid, a colorless, oily-looking liquid, very greedy of moisture and therefore used as a drying agent. The ordinary acid, containing from 30 to 38 per cent water, is known as "chamber acid" from the lead chambers in which it is made.

The manufacture of sulphuric acid is one of the great chemical industries, although it does not figure in commerce to any great extent because it is so difficult to ship the acid safely that large consumers generally make their own. There are two important processes of manufacture. In the old lead chamber process—to give a mere skeleton of some rather complicated reactions—sulphur in the form of "brimstone" or pyrites or other compound is burned, giving sulphur dioxide. These fumes then pass through a series of lead chambers in which they react with steam and certain oxides of nitrogen to form the diluted chamber acid which may be evaporated to obtain a more concentrated acid. In the newer contact or catalytic process, the presence of a catalyzer (*see* Platinum) induces sulphur dioxide to unite directly with oxygen from the air to form sulphur trioxide. This is dissolved in previously made acid, and water is added. The water and the trioxide unite to form sulphuric acid; that is, H_2O+SO_3 becomes H_2SO_4.

SUMACH (*shụ'măk* or *sụ'măk*). During autumn in the northern part of the United States and in southern Canada, some of the most glorious coloring is shown by the staghorn sumach (also spelled *sumac*). This rugged shrub or small tree owes the first part of its name to the resemblance between its crooked branches and a stag's horns. In summer the downy green foliage

makes a fine background for the conelike clusters of hairy, crimson fruit, which grow on a long spike.

Flourishing from Maine west to Minnesota and south as far as Florida and Texas, the dwarf or flame-leaf sumach resembles the staghorn in the brilliant autumn coloring of its leaves and fruit. Along with several others, both the above species are commercially valuable for the tannin they yield.

The most common of several species of poisonous sumachs is the poison or swamp sumach. Found in swampy places from New England west to Minnesota and south to Florida and Louisiana, it can be recognized by its drooping clusters of greenish-white fruit.

About 150 species of sumach are native to the temperate and subtropical regions of both hemispheres. The famous lacquer of China and Japan comes from the juice of a cultivated sumach (*see* Lacquer).

Scientific name of staghorn sumach, *Rhus typhina;* of dwarf sumach, *Rhus copallina;* of poison sumach, *Rhus vernix.*

SUMA'TRA. When Batak natives in the wilds of Sumatra decide to hunt down a troublesome tiger, they call in the *guru* or witch doctor. He leads the village in magic ceremonies, which apologize in advance to the tiger for killing it. Then, after the tiger is killed, more ceremonies are performed to appease its spirit. And this may happen not far from modern oil fields, while airplanes fly overhead.

Such a contrast is typical of Sumatra, the world's sixth largest island, in the East Indies. Much of the coast is low, swampy, and untouched by man; dense groves of mangroves shelter only insects, monkeys, and birds. But near this wild coast are some of the world's finest rubber plantations. And the primitive native life in many places contrasts with the high Malay culture around Padang, with its terraced rice fields and colorful villages, topped with the minarets of mosques.

> **FACTS ABOUT SUMATRA**
>
> **Extent.**—Length, about 1,050 miles; greatest width, about 260 miles. Area, 163,000 square miles. Population, about 7,980,000.
>
> **Surface Features.**—Barisan Mountains with central valley containing Lake Toba, 502 square miles; about 90 volcanic cones, 12 active; highest point, Mount Korintji, 12,484 feet; chief rivers, Indragiri, Jambi, Musi; chief harbors, Belawan, Benkoelen, Palembang, Sibolga, Teloekbetoeng.
>
> **Cities.** — Teloekbetoeng (population, 145,000); Palembang (110,000); Medan (75,000); Padang (50,000); Sibolga (40,000); Koeta Radja (27,000).

A Mountain Backbone and a Tropical Climate

This island of remarkable contrasts is essentially just one great mountain range, the Barisan Mountains. This range belongs to the uplifted border which runs around Malaya and the East Indies (*see* East Indies). The outer or southwestern edge, toward the Indian Ocean, is steep. The northeastern side slopes gently to the Strait of Malacca and the Java Sea. Only a few of the many rivers have mouths wide and deep enough to serve as harbors.

The climate varies with the seasons, even though Sumatra lies squarely across the Equator, because the *heat* equator moves north and south with the sun. From September through January the northeast monsoon strikes the northeast coast, dropping heavy rain on the mountainsides. Meanwhile the other coast has a dry season. Thereafter each coast has a reversal of season. The rainfall everywhere is at least 60 inches a year; some places have more than 160 inches.

Wild Life in the Equatorial Forest

A thick forest of palms, camphor trees, pepper vines, ebony, and other tropical plants grows from sea level to well up the mountains. It is spotted with orchids and with the huge flowers of the Rafflesia, another parasite, which has blossoms three feet across. The heights have rhododendrons, oaks, and chestnuts. Wherever mountain crests create rain shadows, eucalyptus and bamboo may grow, or the land may be covered with the tall tough grass *alang-alang.*

The forests teem with Asiatic animals such as the elephant, tapir, rhinoceros, Malay bear, and tiger. The hosts of monkeys and apes are headed by the orang-utan. Flying lemurs and flying foxes are seen among the parrots, hornbills, trogons, pheasants, and woodpeckers. Crocodiles infest the river mouths.

Native Ways Still Survive

Unlike its neighbor Java, Sumatra has been touched only slightly by white enterprise, except in the southeast and in patches elsewhere along the coasts.

Many scholars believe that Sumatra was the center from which the mongoloid Malays spread throughout the East Indies, after the 12th century. Today only one small group of true primitives, the Kubus of the middle east coast, show any Negrito blood; the other less advanced peoples, principally the Bataks and the Gayos in the northern mountains, are mixed Malay and Polynesian. Even the most backward among them grow rice and other crops, work in metal, and build fine houses with projecting roofs which keep out the heavy rains.

The coastal Mohammedan Malays have Hindu and Arab blood, particularly the Achinese in the northwest. These people traded as far as Egypt and Japan in the 13th century, and they resisted Dutch rule even in the 20th century. The most advanced Malays live near Padang.

White peoples visited the island for trade only, except for a Dutch foothold in the east, until the British agreed to leave Sumatra to the Dutch, in a general settlement of colonial rivalries in 1824. The Dutch started growing fine tobacco near Medan in 1863. Later they planted coffee on the southern mountain slopes, and tea on the uplands behind Medan. After rubber was introduced near Medan in 1905, it became the leading product. Palembang in the southeast is in the center of important petroleum fields. Some coal and iron are mined near by.

SUMNER, CHARLES (1811–1874). For nearly 20 years Charles Sumner, the Massachusetts antislavery agitator, was the most conspicuous figure in the Senate of the United States. After completing a course in the Harvard Law School in 1834, he practised law for three years, and then went abroad. There he formed acquaintances with leading public men.

In 1845 Sumner began to interest himself in politics, and the same year he delivered the Fourth of July oration in Boston, taking for his subject, "The True Grandeur of Nations." It was in this address that he took the extreme ground that "there can be no peace that is not honorable; there can be no war that is not dishonorable."

This oration decided Sumner's future career. He had amazed himself, as well as his friends, by his powers as an orator, and he determined to go on the lecture platform. He at once became one of the most conspicuous foes of slavery, and as a result he was elected to the United States Senate in 1851 as a Free-soil candidate. During his first session in Congress he declared that "freedom was national; slavery sectional." When the Kansas-Nebraska Bill was introduced into the Senate Sumner opposed it with all his might, as one

> Who, momently by Error's host assailed,
> Stands strong as Truth in greaves of granite mailed.

In the course of these debates Sumner made some bitter attacks on the South, and on Andrew Butler, senator from South Carolina. As a result, he was brutally beaten over the head with a heavy cane by Congressman Preston Brooks, a relative of Butler's, while seated defenseless at his desk in the solitude of the senate chamber, after that body had adjourned. Sumner suffered from the effects of that attack all his life, and it was nearly four years before he was physically able to reënter public life.

Sumner returned to the Senate in time to take part in the last thrilling episodes which preceded the Civil War. During this period he opposed any compromise with the supporters of slavery. Emerson declared that for many years Sumner was the "conscience of the Senate," and Lincoln shrewdly characterized him when he said, "Sumner is my idea of a bishop." Unfortunately, Sumner seemed sometimes quite as much impressed with his own grandeur as with the grandeur of the nations, and his success as a public speaker made him seem conceited and overbearing.

During the Civil War he urged the immediate emancipation of the Negro, and he was one of the foremost advocates of giving the ballot to the recently freed slaves. His greatest opportunity for service was as chairman of the committee on foreign relations. His knowledge gained during his three years' residence abroad was of inestimable value, but he sometimes seemed to forget that the chief direction of foreign affairs was not in his hands but in those of President Lincoln and of Seward, his secretary of state. With the latter Sumner was never able to coöperate effectively.

With the close of the war Sumner's period of greatest usefulness was over. Although he played a prominent part in the period of Reconstruction, it was not a part which was particularly helpful to the country. He was preëminently an agitator, and the time called for constructive work, not for agitation. This is probably the reason that today we do not rank Sumner as did the men of his own time, when they coupled him with Lincoln as "the two most influential men in public life."

OUR GIANT SUN *and Its* GIANT TASKS

Besides Giving Us All Our Food and Heat and Light, It Makes and Distributes Our Weather, Keeps the Waterfalls Falling and the Winds Blowing, and Holds Big and Little Worlds in Their Appointed Paths

SUN AND SOLAR SYSTEM. An old catch-question is, "Which is the nearest star?" If you know the catch you will answer, "The sun." For the sun is really a star. But because of its nearness, the sun and the other stars are as different to us on the earth as day and night. And just as the light of the sun makes the stars disappear from the sky, so the sun's importance to us makes all the other stars put together seem insignificant.

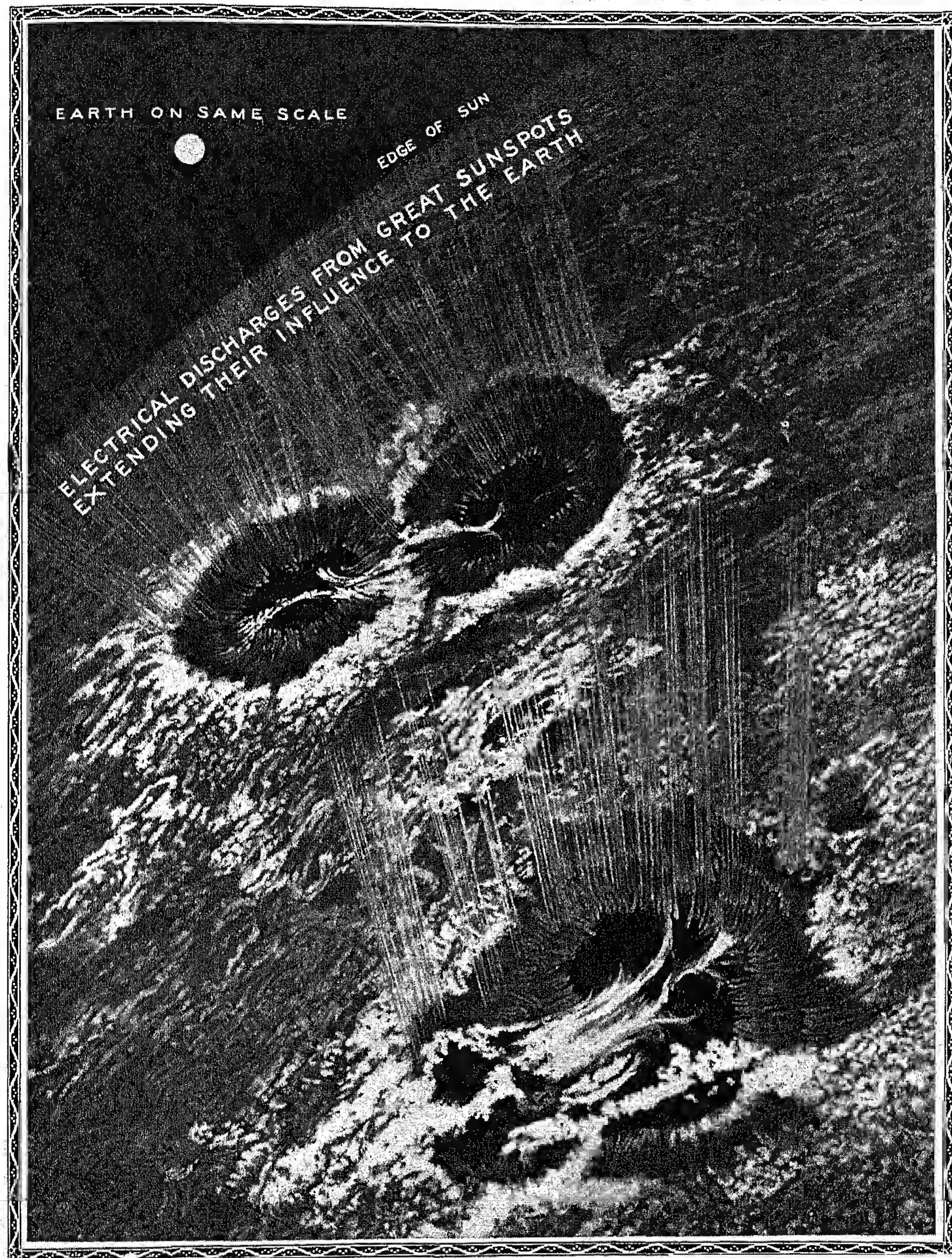
The earth itself came from the sun in the beginning. A fiery mass was torn away and whirled out into space. There the sun's force of gravity made it swing around in a great curve and held it captive like a stone on the end of a string. When the fiery mass cooled and became solid, the sun kept it lighted and warm (*see* Earth).

Some of the Sun's Great Gifts to Us

Without heat from the sun, even the atmosphere would have frozen and life could not have started. Without sunlight no green plants could live (*see* Plant Life). And without plants, animals and men could not exist. When we burn our fuels, we are using the sunlight of times past. Our coal and petroleum are remains of ancient plants and animals. When the plants and animals were growing millions of years ago, they absorbed the energy of sunlight and they have kept it ever since in chemical storage. When we set fire to their remains, we release that stored-up energy (*see* Fuels; Coal; Petroleum; Energy). We have water power because the heat of the sun lifts into the air the moisture that later turns into rain (*see* Rainfall). The heat of the sun makes the winds that carry the moisture to our fields (*see* Winds). The list of important things that we owe directly or indirectly to the sun is almost endless.

Distance, Size, and Heat of the Sun

The distance of the sun from the earth varies during the year, but it averages about 93 million miles. If a newborn child were placed on a plane flying toward the sun at 150 miles an hour, he would be nearly 71 years



Across some 93,000,000 miles of space—so far that the little pealike object in the left corner of the page which represents the earth, would have to *be more than* 200 feet away from the section of the sun's disk if the distances were on the same scale as the objects pictured—electrical discharges beat down on our tiny planet. Well for us that the pulsing energy of the great life-giving dynamo in the sky never ceases! Well too that we are at a safe distance from the flame-licked whirlpools into which our earth might drop like a pellet of waste fluff shaken into the live coals of a grate fire! The study of these "sunspots," as they are called, has been for years one of the most interesting branches of astronomy.

FOLLOWING THE MIDNIGHT SUN

This picture, made by exposing the same plate at 15-minute intervals, was taken by Donald MacMillan at the northern end of Baffin Bay. It shows how, in these high latitudes, the sun seems to move almost horizontally without setting.

old when he arrived there. The sun does not seem very large. A fair-sized pea held at arm's length (25 inches) from the eye will cover its disk. But to look even this large, an object as far away as the sun has to be of vast size. Astronomers compute that the diameter of the sun is 109 times that of the earth. If the earth could be placed at the center of the sun, the moon, revolving around the earth, would reach only about halfway to the sun's surface.

Knowing the distance to the sun, we can also tell how hot it must be, in order to give out the heat the earth receives. This heat is measured by the *solar constant*, as explained in the article on Climate. Hence we know that the sun must have a temperature at its surface of about 10,000° F., or about 5,500° C.

The Nature of the Sun

Such heat is great enough to change any rock or metal to glowing gas. Therefore the sun cannot be solid, like the earth. It must be a globe of hot gas. The telescope shows this gaseous nature plainly. Dark sunspots and bright spots called *faculae* come and go over the white-hot surface. As the sun rotates upon its axis, the spots move with the surface; but they complete a revolution at the Equator faster than they do near the poles. This could not happen on a solid sun.

The surface of the sun's body is called the *photosphere*, meaning "light sphere." Around it is a layer of lighter and cooler gas called the *chromosphere*, meaning "color sphere." This name is given because this cooler gas gives out scarlet light. The photosphere has tremendous clouds, called *flocculi*, of calcium vapor.

Great streamers of scarlet matter, called *prominences*, often shoot out through the chromosphere, sometimes for hundreds of thousands of miles. Some are like flames; others resemble immense bubbles that swell and then burst. Around all this is a zone of electrified material that is far thinner than any gas. Usually this zone cannot be seen, because of the brighter light from the hotter parts. But when the sun's disk is covered in a total eclipse, this zone shows as a dazzling, pearly-white *corona*, or crown.

The Sun and the Solar System

When the sun gave birth to the earth, it gave off also the other planets of the solar system; and it still holds them in their orbits by its gravitational attraction. It can do this because it weighs as much as 332,000 earths and exerts 27.9 times as much gravitational force as the earth does. Because of this, 100 pounds of the earth's matter would weigh 2,790 pounds, or nearly a ton and a half, on the sun. (*See* Gravitation; Planets.)

The belief that the earth came from the sun is supported by the fact that they contain the same chemical elements. The luminous parts of the sun consist largely of hydrogen. More than 60 other elements have also been detected, including oxygen, nitrogen, silicon, magnesium, sodium, potassium, calcium, phosphorus, sulphur, iron, aluminum, and copper. (The methods by which astronomers gain this knowledge are explained in the article on Spectrum and Spectroscope.)

Scientists are still uncertain about the source of the sun's heat. The old theory that the sun was burning was given up when geologists produced evidence that the sun had been hot for hundreds of millions of years. No substance could remain burning that long.

The physicist Hermann von Helmholtz then suggested that the sun's force of gravity might be continually drawing together the matter in the sun and compressing it. Such compression would produce heat, but Lord Kelvin calculated that this process could only continue for some 46 million years.

Modern Theories about the Sun's Heat

Today scientists believe that the sun's heat must come from processes that depend upon the electrical nature of matter. One process is release of energy

FACTS ABOUT THE SUN

Distance from the Earth—Minimum (January), 91,300,000 miles; maximum (July), 94,500,000 miles; mean, 92,897,000 miles.

Diameter—864,100 miles.

Density—1.41 times the density of water; ¼th as dense as the earth.

Weight in Tons—About 2,184,759 sextillion tons. This is written as 2,184,759 followed by 21 ciphers.

Surface Temperature—Estimates range from 9,450° F. to 11,070° F.

Output of Energy—894,700,000 calories a minute from each square meter, or 70,000 horsepower from each square yard. Total output in calories a second, 907 followed by 23 ciphers.

Width of Disk—About ½ degree (32′).

Period of Rotation—About 25 days at the Equator, 34 days at the poles.

through radioactivity. Or heat and pressure in the sun may change matter into energy (*see* Atoms and Electrons; Physics; Radium and Radioactivity).

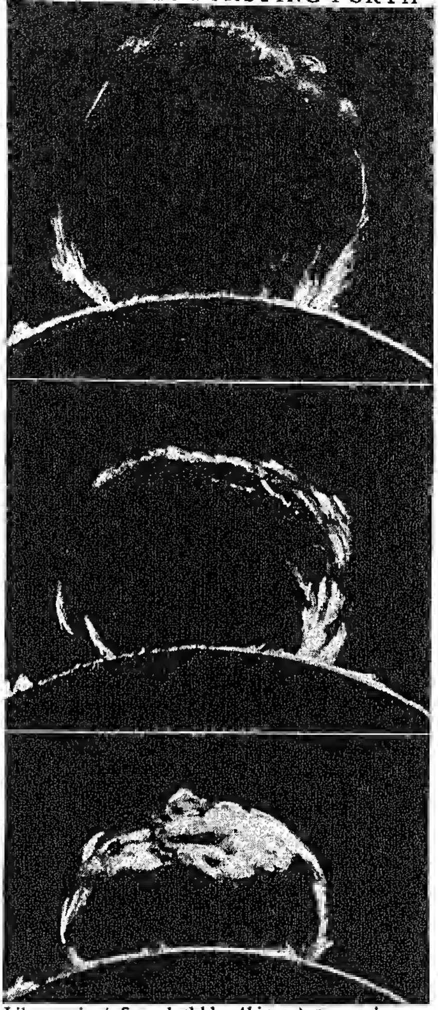
This is not the same as the burning of matter. Burning changes matter from one form to another, and releases some heat while doing so. But when matter changes into energy, one ounce of matter is estimated to yield energy enough to melt $1\frac{1}{4}$ million tons of rock. To keep the sun hot in this way, 4,200,000 tons of matter would have to be converted into energy each second. But even so, 1 per cent of its huge mass could maintain the heat of the sun for 150 billion years.

Sunspots and Their Effects

Sunspots which appear through the telescope as small dark holes in the sun's white disk seem to be a sort of boiling out or release of electrical energy from within the sun. This release sends beams of negatively charged electrons shooting into space.

Some of these electrons enter the earth's atmosphere, where they are thought to produce various disturbances. They are supposed to cause auroras, and to disturb radio transmission by raising or lowering the Kennelly-Heaviside layer of electrified material in the upper atmosphere (*see* Aurora Borealis; Radio). They also seem to increase the amount of ozone in the upper atmosphere. The added ozone may absorb more of the sun's heat than usual, and thus affect our weather. It may also have a stimulating effect upon human beings.

SUN FLAMES BURSTING FORTH



Like a giant fiery bubble, this solar prominence grew to be 250,000 miles high—more than 30 times the diameter of our earth. The start is shown at the bottom, and the final burst at the top.

Astronomers are sure that sunspots are electrical in nature, because they produce what is called the *Zeeman effect* in spectroscopes. This effect—a splitting of spectral lines—takes place only when light has passed through a magnetic field. From studies of this effect in 1906 and later years, the famous American astronomer George Ellery Hale proved that the spots are really gigantic whirls of electrified matter that come bursting from the sun's interior in pairs. Each spot seems to be one end of a tunnel-like disturbance.

Most sunspots last only a few days, but some last two months or more. They seem to come and go in a regular cycle of about $21\frac{1}{5}$ years. At first they appear about one-third of the way between the sun's Equator and each pole. For about three years they increase in number, and appear nearer and nearer the Equator. Then the number decreases. This portion of the cycle ends in about 11 years, with only a few spots almost on the Equator. Meanwhile the second half of the cycle has started. In this, the direction of whirl and the electric polarity are reversed. This reversed cycle rounds out the complete period of $21\frac{1}{5}$ years.

The sunspot cycle, some meteorologists think, may be the cause of certain periodic changes which have been observed in climate (*see* Climate). Since periods of maximum sunspot activity occurred in 1927 and 1938, astronomers expect similar maxima in 1949 and 1960.

Use of Spectroheliograph

A valuable aid in studying the sun is Hale's spectroheliograph. This instrument is a combination of a spectroscopic camera and a telescope. By using a single line of the spectrum to photograph all parts of the sun's disk in succession, it produces an image revealing otherwise invisible features of the sun's prominences and atmosphere.

SUNDAY SCHOOLS. "Ah, sir! Could you take a view of this part of the town on a Sunday, you would be shocked indeed! The street is filled with wretches who spend their time in noise and riot, cursing in a manner so horrid as to convey an idea of hell." Thus a woman of the pin-factory district of Gloucester, England, spoke to Robert Raikes, editor of a newspaper, a century and a half ago. Three years later Raikes wrote: "A woman who lives in a lane where I fixed a school told me that the place was a heaven on Sunday compared to what it used to be."

This change was brought about by the first Sunday school. Raikes established it in 1780, with four teachers. The hours were from ten to twelve in the morning, and from one to five in the afternoon. The children attended church, but much of their time was spent in learning to read and write, for this was 50 years before free education began in England.

Raikes' idea spread rapidly, and today one out of every six persons in the United States and Canada attends some Sunday school. In America instruction for

children of the congregation had early been a part of the Sunday service. But a more general Sunday school, on lines laid down by Raikes, was not organized in the United States until after the Revolution. The first was established in Virginia in 1786 by Francis Asbury, John Wesley's famous assistant and the first bishop of the Methodist Episcopal church ordained in America. Soon after this, Katy Ferguson, a poor negro woman of New York City, who had never heard of Raikes, organized a Sunday school for street children.

The rapid spread of the Sunday school in the United States was largely due to the American Sunday School Union, which was organized early in the 19th century. This organization sent out missionaries into the West in the first half of the century, and schools were formed from the Alleghenies to the Rockies and from the Great Lakes to the Gulf. The movement later became international. International conventions are now held every two years, and an international committee, appointed every six years, maps out the course of study which is followed in a large proportion of the world's Sunday schools, especially those of evangelical faith. Other church denominations, including the Catholic, have organizations and programs of their own.

SUNDEW. There is something almost human—or perhaps it would be more exact to say inhuman—about the way the treacherous little plant called the sundew ensnares its insect prey. The upper surface of each leaf is covered with about 200 hairlike projections or "tentacles"; these are provided with glands which give out a sticky fluid attractive to insects. Each leaf seems to be covered with hundreds of glistening dewdrops; hence the name. If an insect touches the tentacles it sticks fast. Then all the neighboring tentacles begin to bend toward the center of the leaf, rolling the insect along and making the leaf look like a little closed fist. As soon as the prey is caught the fluid secreted by the tentacles becomes acid, containing digestive properties which make soluble all of the nitrogenous parts of the insect.

After the insect is digested—usually about two days—the tentacles all recurve and the leaf trap is set for another visitor. In Portugal there is a plant related to the sundew which catches so many flies that the peasants hang branches of it in their cottages to rid themselves of these pests.

The sundew (genus *Drosera*) is one of the so-called "carnivorous" plants. Several species are found in North America. They are inconspicuous little plants, with round or oval leaves in a rosette, and they grow chiefly in swampy places. (*See also* Pitcher Plants; Venus's Fly-Trap.)

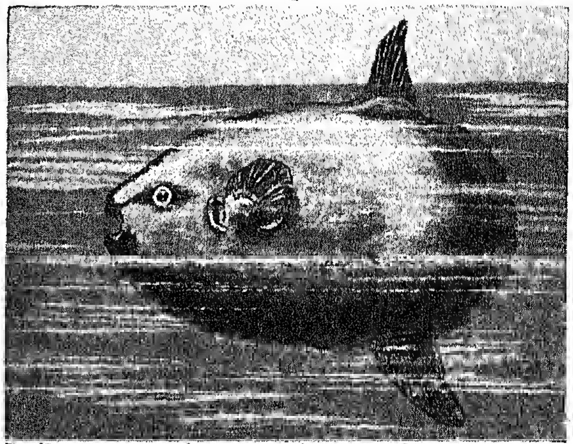
SUNFISH. Where is the rest of him? This is the first question suggested by a glance at the ocean sunfish. What a huge monster he would be, you think, if his tail were not "cut off just behind the ears!"

The true sunfish is this immense creature who wins his title by basking on the surface of the ocean in the hot light of noon. Specimens eight feet long and weighing 1,800 pounds have been caught.

The shape of this fish is like a watermelon seed, and he appears to be nothing but head. Above and below the part that would correspond to the neck are two big triangular fins. Just at the place where he should begin to widen out into a regular fish shape, he stops altogether. It is not surprising that scientists, gazing upon him in wonder, call him a *moloid pelagic plectognath*, or *Mola mola*, for short!

The ocean sunfish is a stupid fish, and will allow men in boats to approach quite close to him before he turns over and dives. For this reason he is easily harpooned, whereupon he puts up a tremendous fight, lashing the water with his two big fins and dragging the craft of his captors at considerable speed over the waves. The sunfish is found in almost all parts of the Atlantic and Pacific oceans. His flesh is not good for food, but he is sometimes caught for the oil which he produces.

A GROTESQUE GIANT



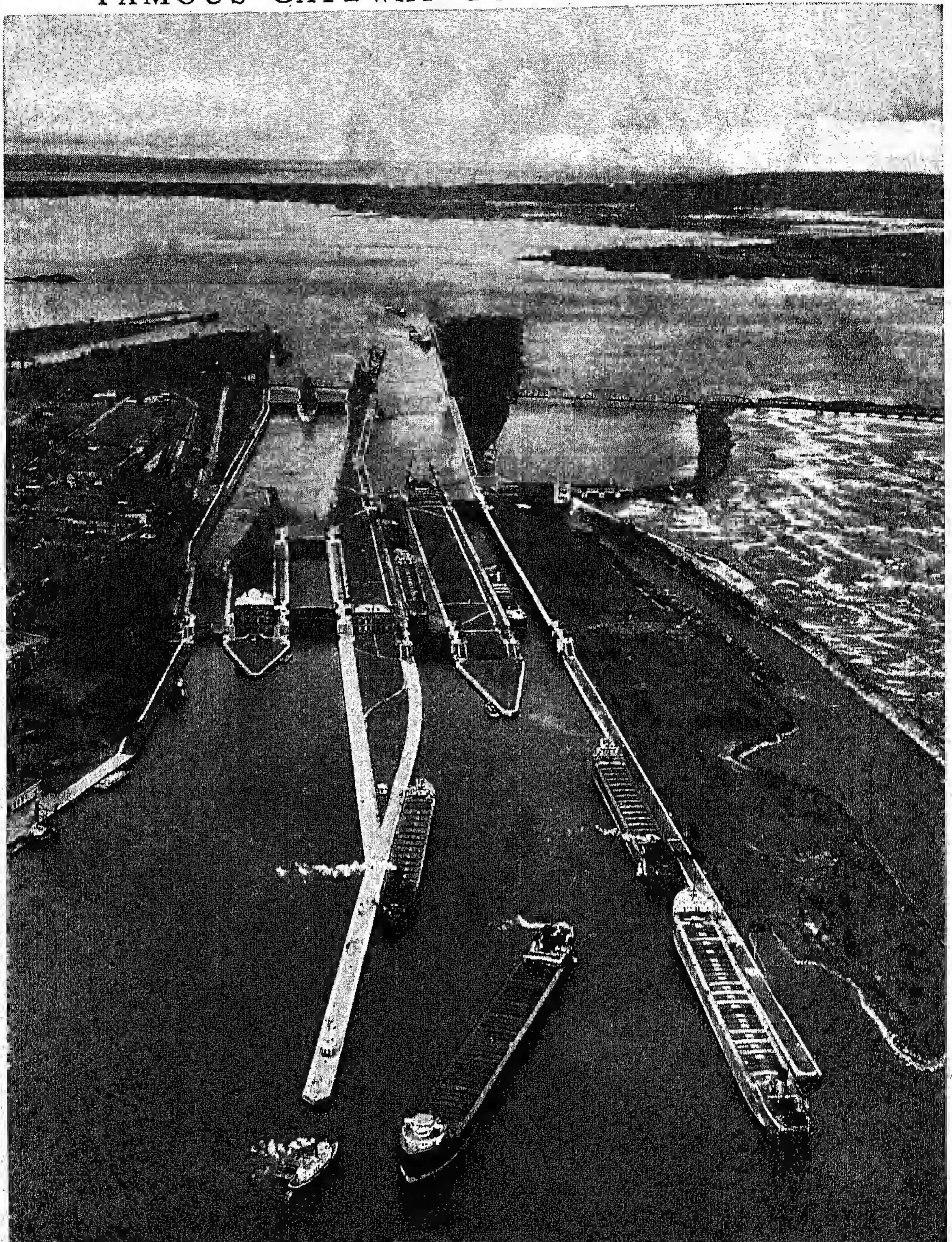
During stormy weather the Sunfish "lies low," but in bright sunny weather he loves to play about near the surface, swimming so high that his back fin projects as shown in the picture, or lying flat on his side. "Stupid," he is called; and he looks it, with that gaping mouth and round, surprised, staring eye.

Very different from this ocean monster are the little freshwater sunfish which are among the most characteristic, best known, and most highly esteemed of the game and food fish of the United States. The handsome common sunfish (*Lepomis gibbosus*) is perhaps the best known of the family. The little green-spotted sunfish, the long-eared sunfish, and the blue gill sunfish, are other well-known representatives of the family (scientifically known as *Centrarchidae*), which also includes the black bass, calico bass, and crappie. Many of them build pebble nests in shallow water, where they will get the full force of the sun's rays, and the male keeps watch over the eggs until they hatch.

SUNFLOWER. When Champlain visited the Indians on the eastern shore of Lake Huron some three centuries ago, he found them cultivating the large common sunflower, the best-known of the many species of this familiar plant. They had probably brought it from its native prairies beyond the Mississippi. Its stalks furnished the red men with a textile

The huge head of the sunflower is actually made up of many small separate flowers clustered together to form that dark center. This is typical of the great plant family *Compositae*, of which the sunflower is a leading member (*see* Flowers). The many small flowers are united into a coöperative colony. Those on the rim of the disk produce the gorgeous spread of yellow petals; those on the inside produce the nectar and the seeds. Botanists consider the sunflower one of the most highly developed of all plants.

FAMOUS GATEWAY TO LAKE SUPERIOR



Airplane view of the American canal and locks at Sault Sainte Marie, Mich., looking west. On the far horizon stretches Lake Superior. Its waters flow toward you through the Saint Mary River, which leads into Lake Huron. At the right are the foaming rapids around which the canal was built. Still farther to the right, not visible, lie the Canadian canal and locks. Each of the two big locks in the center is 1,350 feet long—one of the longest in the world. The freighters, designed for enormous loads of ore, grain, and coal, carry more cargo through these waters in normal years than passes through the Panama Canal and the Suez Canal combined.

fiber, its leaves with fodder, its flowers produced a yellow dye, and its seeds furnished food and oil for their hair. Early European settlers in Canada were quick to appreciate the usefulness of this plant and sent seed home to Europe. Sunflowers are now grown commercially in parts of the United States and in many foreign lands. The seeds, rich in fat and protein, are fed to poultry and live stock, or are crushed for edible and industrial oils. They may be roasted and eaten like peanuts. The whole plant makes good silage.

The common sunflower is a giant among composite flowers, having large coarse heart-shaped leaves, and brown-centered golden blossoms which often measure nearly a foot across. Contrary to popular belief the flower does not turn to follow the sun, but gets its name from the resemblance of the golden-rayed heads to the sun.

Scientific name, *Helianthus annuus*. Flowerhead flat, 4 to 12 inches across, with brown round disk florets crowded in concentric circles on the flat round disk; ray florets yellow, numerous, long, radiating in series from the disk. Stem rough, hairy, 6 to 10 feet tall. Leaves large, broad, coarse, petioled, and usually growing alternately on the stem.

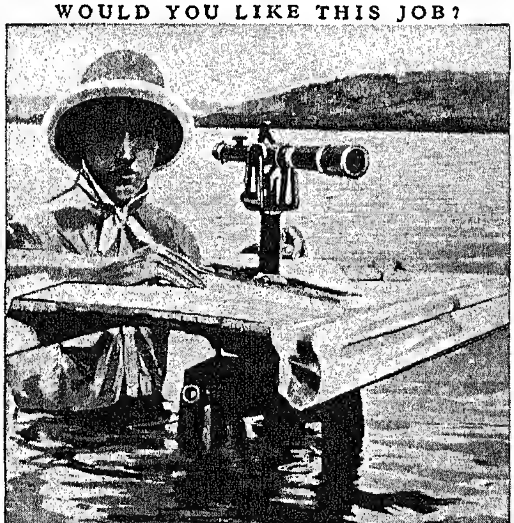
SUPERIOR, LAKE. The largest body of fresh water in the world, Lake Superior is also the deepest, the most northern, and the coldest of the North American Great Lakes. Its area is 31,820 square miles, and you may steam for 30 hours across its surface without sighting land, for it is 350 miles from end to end. In places the water is 1,290 feet deep, the bed of the lake lying 406 feet below ocean level and the surface 602 feet above. Even summer rarely brings its temperature much above 40° F., and until far into May its ports are icebound.

From the rocky and wooded shores more than 200 streams pour their waters into Lake Superior. Of the islands, the largest, Isle Royale, more than 40 miles long, falls within the United States boundaries. At the western end of the lake lies the great double port Duluth-Superior, at the edge of the iron regions of Minnesota and the farming country of the west. From here giant freighters carry their cargoes of ore and grain down through the locks of the Sault Ste. Marie at the eastern end, on their way to other ports of the Great Lakes, the return freight being largely coal. About midway on the southern shore the spur-shaped peninsula of the "copper country" juts 60 miles into the lake. Here one-seventh of the world's supply of copper is mined every year, and vessels have been known to set out from the ports of Keweenaw Bay bearing a cargo of copper ore worth a million and a quarter dollars. Lake Superior whitefish are highly esteemed throughout the Middle West, and other fish from these cold clear waters are among the best to be found in all the lakes. (*See* Great Lakes.)

SURVEYING. How do you know where the boundaries of your farm or city lot are? Because they have been mapped or laid out by skilled surveyors. It is by surveying that the boundaries of cities, states, and countries are laid out, as well as of private lands; and surveying is also used in locating streets, roads, railroads, and all other positions or courses on the earth's surface. Surveyors must know geometry and trigonometry and be able to use delicate instruments with great accuracy. In big cities land is often worth hundreds of dollars a square foot, and an error of a fraction of an inch would be costly.

Surveying, which—at least in a rudimentary form—is nearly as old as civilization, is a branch of civil engineering. It is the science of ascertaining the shape and size of any portion of the earth's surface—that is, the relative location of points and lines—and representing them on maps or diagrams. It includes also the reverse operation of locating or staking out on the ground points and lines drawn in plans or maps—as for the construction of buildings, railways, canals, and the like.

WOULD YOU LIKE THIS JOB?



This is the way a surveyor often has to work along portions of the Florida, Porto Rican, and Philippine coasts. There the land is covered with a dense impenetrable mat of vegetation and the shore is fringed with semi-liquid mud flats, so that the hard coral bottom of the waters off shore frequently affords the only available support for the plane table.

There are two principal kinds of surveying—plane and geodetic. Plane surveying—including land, topographic, and hydrographic surveying—deals with comparatively small areas. It treats the earth's surface as a plane, disregarding its curvature. Geodetic surveying or "geodesy" deals with larger areas and is more accurate, taking into account the curvatures of the earth's surface.

The simplest method of land surveying is to divide the ground to be surveyed into several triangles and to calculate the area of these triangles. A base line of convenient length is marked off and measured with the greatest accuracy. Another point is chosen for the apex of the triangle and the angles it makes with each end of the base line are measured. From these angles and the length of the base the area of the triangle is calculated. By continuing this process until the whole piece of land is covered with a network of triangles, the location of all important points throughout the entire area is computed. A number of spots

are marked with monuments, to serve as starting points for any local surveys that may be desired.

In making his measurements and determining his angles, the surveyor uses special instruments of great accuracy. The principal instrument is the "transit" (an improved form of the "theodolite"), which consists of a telescope mounted on a tripod with a compass and a leveling glass attached. If a straight line running northward is to be laid out, the instrument is swung around until the compass shows that it is pointing directly to the north, then the surveyor looks through the telescope, while his assistant carries a long rod forward, planting it in the ground at the direction of the surveyor in the exact line of sight, determined by a hair which is stretched perpendicularly across the inside of the telescope. The transit is then moved up and planted exactly over the spot marked by the rod, the assistant moves forward again, and the whole process is repeated. If the line is to bend at a certain angle, a scale on the transit tells when the telescope has been moved to that angle and the sighting goes on as before.

When distances are measured along the line of sight, wire chains or metal tapes are used. For farm or public land surveys in the United States the Gunter chain is used, which is 66 feet long, divided into 100 links each 7.92 inches. These are units of acre measurement. But for more accurate engineering work, steel tapes marked in inches, feet, and ten-foot lengths are used. For very accurate work, tapes are made of "invar," an alloy of nickel and steel which does not expand or contract in response to any changes of temperature ordinarily encountered.

The "level" is an instrument somewhat like the transit, but used chiefly to determine grades, that is, the amount of rise and fall of the ground surface. It is used chiefly for railway and topographic surveys, the latter dealing with the shape of physical features, such as rivers, hills, and mountains. The "plane table" is a drawing board, which may be fixed horizontally on a tripod with a spirit level; it is usually used with an "alidade," a combined ruler and telescope for drawing lines parallel to the telescope setting. Some surveying is now done much faster than formerly from airplanes. (*See* Airplane; Photography.)

Geodetic surveys, which take into account the curvature of the earth, are carried on by governments to map the coast lines, to determine the exact heights and locations of important points, the boundaries and areas of states, of large bodies of water such as the Great Lakes, and international boundaries. For this purpose geodetic survey stations are established in various parts of the United States, Canada, and Mexico, whose exact positions are determined by astronomical observations, corrected by a complicated process of triangulation. The central station for North America is at Meades Ranch, Kan.

Hydrographic surveying deals with the area, shape, and depths of bodies of water, and is made with the assistance of soundings. By this means, channels, banks, and sunken reefs are charted, and ocean depths marked on maps. (*See also* Lands, Public.)

FEATHERED HERALDS *of* SPRINGTIME

SWALLOWS, SWIFTS, AND MARTINS. Are you troubled by mosquitoes and flies? Put a martin house in your dooryard and you will soon be relieved of these pests. For the martin and his relatives, the 200 species of swallows and swifts, are insect-eating birds and feed especially on the small flying varieties. They capture them in the air, and so keep their mouths widely agape when on the wing.

The swallow family is known and loved throughout the world. To many the unfailing sign of spring is the arrival of flocks of these picturesque steel-blue birds. The pointed wings and forked tail are characteristic of the family, which in general has dark over-plumage, changing to lighter below. The species vary in size from five and one-half to eight inches, but the habits are similar for all.

They live mostly on the wing. In migrating, unlike other birds, they travel only during the day, for they can feed as they fly, roosting in marshes or trees at night. Most of the swallows nest in colonies and all lay from three to seven eggs. The choice of place and the manner of building, however, varies widely with the different species.

The purple martin is the aristocrat of the swallow family and prefers to carry the leaves, straw, and mud with which he builds into a box erected for his use. This home he defends against any other bird, even the crow or hawk. His entire body is covered with dark steel blue, the wings and tail being almost black-purple. The violet-green swallow, not five inches long, lives in the western United States. It is named for the colors on its back, the belly being white.

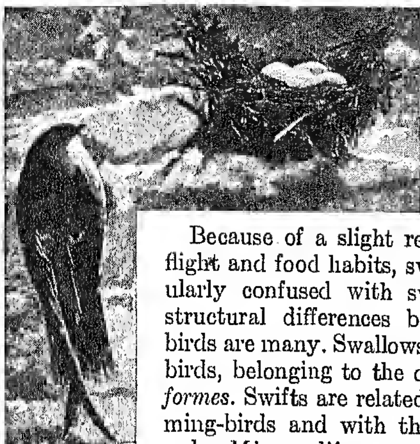
The barn swallow, with his under-feathers of chestnut red, is the master mason of the family, and constructs a wonderful little nest-house of straw, held together with mud-pellets, and attached under the eaves or against the beams of buildings and under the ledges of cliffs. As the song says:

The swallow is a mason,
And underneath the eaves
He builds a nest and plasters it
With mud and hay and leaves.

Bank and rough-winged swallows have a curious way of tunneling into a sand-bank, sometimes to a depth of three to five feet. Into this burrow they carry straws and sticks and build a bulky nest.

Holes in trees or old stumps are the usual nesting sites of the tree swallow, but this species sometimes nests in the bird boxes made by man.

CHIMNEY SWIFT AND HER NEST



A gipsy corrupted by civilization, the Swift has forsaken the hollow tree in which it used to build its home for a disused chimney.

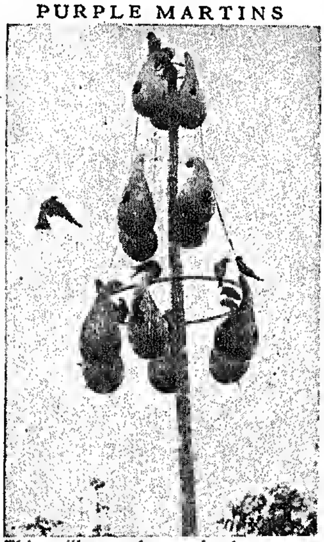
Because of a slight resemblance in flight and food habits, swifts are popularly confused with swallows. The structural differences between these birds are many. Swallows are perching birds, belonging to the order *Passeriformes*. Swifts are related to the humming-birds and with them form the order *Micropodiformes*.

The swift constructs a nest of twigs held together by a glue-like liquid substance which flows from the mouth of the bird during the mating season. In some cases, notably in that of the swifts of Japan and China, the nests are composed entirely of this glue, with perhaps a feather lining. These nests are considered a table delicacy, and "bird's-nest soup" is a dish of which both Japanese and Chinese are very fond.

Chimney swifts are about five and one-half inches long, usually sooty or brown color above and lighter below. Because of the shape of its claws the bird never perches on trees or other objects, but alights in a hollow tree or chimney where it clings to the sides by its sharp claws, supporting the body by pressing the tail against the wall. In such homes they glue their shelf-like nest so firmly that it supports not only the mother but also her five or six babies. Of course if the chimney is heated, disaster follows.

When the children are able to fly, the swifts gather in immense flocks and use the same chimney for sleeping quarters. John Burroughs tells of watching 10,000 swifts playing above a single tall chimney, into which the entire flock finally disappeared for the night. This they continued to do for a whole month before migrating to the south.

PURPLE MARTINS



This village of gourds houses a colony of the "biggest, handsomest, jolliest, and most domestic" of the swallow family—the Purple Martin.

There is a touch of mystery about the swift's migration. No one has yet discovered where they spend the time from fall till spring. In November they gather on the northern coast of the Gulf of Mexico, an innumerable host. Then they disappear! The last week in March a joyful twittering far overhead announces their return to the Gulf Coast. Where they have been in the meantime is still the swifts' secret. (For illustrations in colors of barn swallow and chimney swift, *see* Birds.)

BARN SWALLOWS

This is one of the hungry chattering broods that populate the eaves of barns and other farm buildings. Before men provided the Barn Swallow with a nesting place, it used to build in caves, niches in rocks, or hollow trees.

Swallows belong to the family *Hirundinidae*. Scientific name of purple martin, *Progne subis subis;* barn swallow, *Hirundo erythrogaster;* tree swallow, *Iridoprocne bicolor;* bank swallow, *Riparia riparia riparia*. The swifts belong to the family *Micropodidae*. Scientific name of chimney swift, *Chaetura pelagica*.

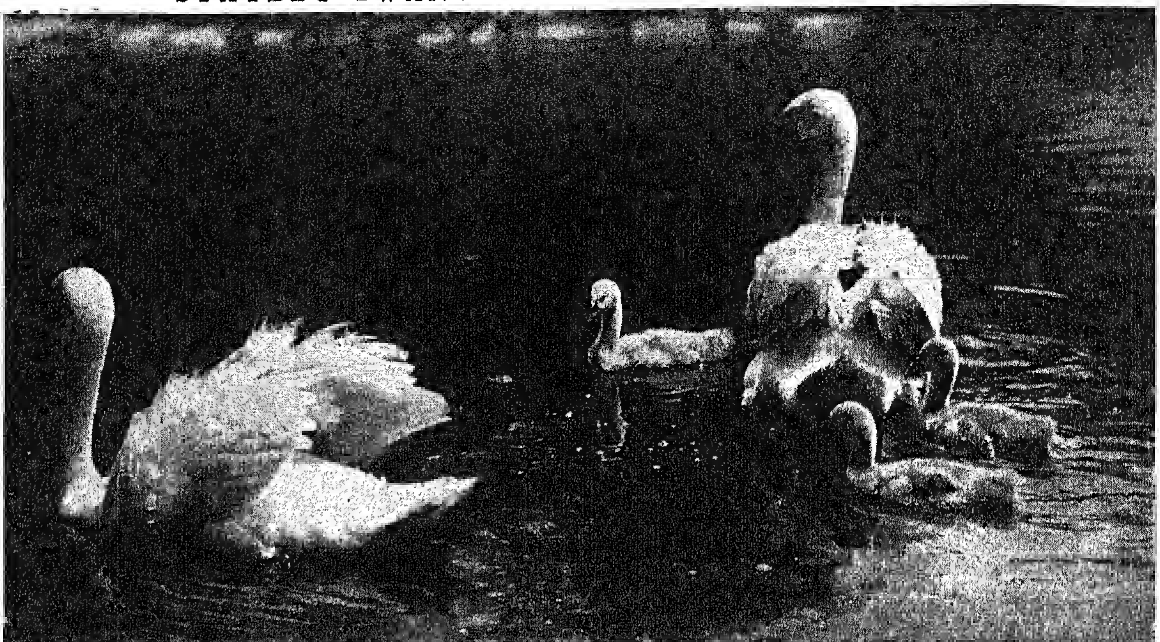
SWAN. The swan is the "royal" bird, so called because in England up to the time of Queen Elizabeth no subject might possess a swan without license from the Crown. The title still clings to the bird, probably because the dignity of its appearance makes it peculiarly apt. The swan frequently appears in myth and fable, and its beautiful plumage, the proud poise of its graceful neck, and its stately movements have made it a favorite subject in literature.

Swans belong to the same group as the geese and ducks, and are almost exclusively aquatic birds. There are eight swan species. They are all large birds, characterized by the length of neck, which in some species is longer than the body. The plumage is generally pure white, sometimes dark about the head. Young birds, called "cygnets," have brown feathers, which are shed for white the second year. The call note is loud and trumpet-like.

The distribution of the swan family is very wide. Wild swans breed in the arctic region, migrating to warmer climates in the winter. The nest of the swan is a large pile of reeds and water plants, and the eggs, about six in number, are of a greenish hue. The birds feed on seeds, roots, small water creatures, and fish spawn.

The common swan of Europe is also called the mute swan, for it is said never to use its voice in captivity. This species, the best known of the family, reaches a length of five feet and a weight of 30 pounds. The plumage is spotless white, the bill of orange-red surmounted by a black knob, and the legs are black. Domesticated swans of this species consort freely with wild swans, which migrate southward toward

STATELY SWANS LIKE GREAT WHITE LILIES



The common or "mute" swan is one of the most graceful of the swans when swimming. Its whiteness as well as its grace is proverbial. A "black swan" to the ancients was a synonym for a freak of nature.

winter. It has been introduced and naturalized along the central Atlantic coast of the United States.

South America is the home of the black-necked swan, a smaller bird with white plumage except for the head and neck of dark seal-brown. Australia has the black swan, with sooty black plumage, white primaries, and coral colored bill. This handsome bird is the state emblem of Western Australia.

In North America the family is represented by two native species—the trumpeter swan, largest of North American wild fowl, and the whistling swan. Both are now very rare. (For picture of trumpeter swan, *see* Birds, B-145*b*). These birds have a great variety of calls, ranging from the high-pitched note of the young birds to the bass-horn notes of the old males. The "swan song" of the dying birds, so long regarded as a pleasing myth, has actually been heard from birds of these species as, after being wounded, they slowly sailed to earth on set wings.

Swans, geese, and ducks form the family *Anatidae*. Scientific names of swans: trumpeter, *Cygnus buccinator;* whistling, *Cygnus columbianus;* mute, *Sthenelides olor*.

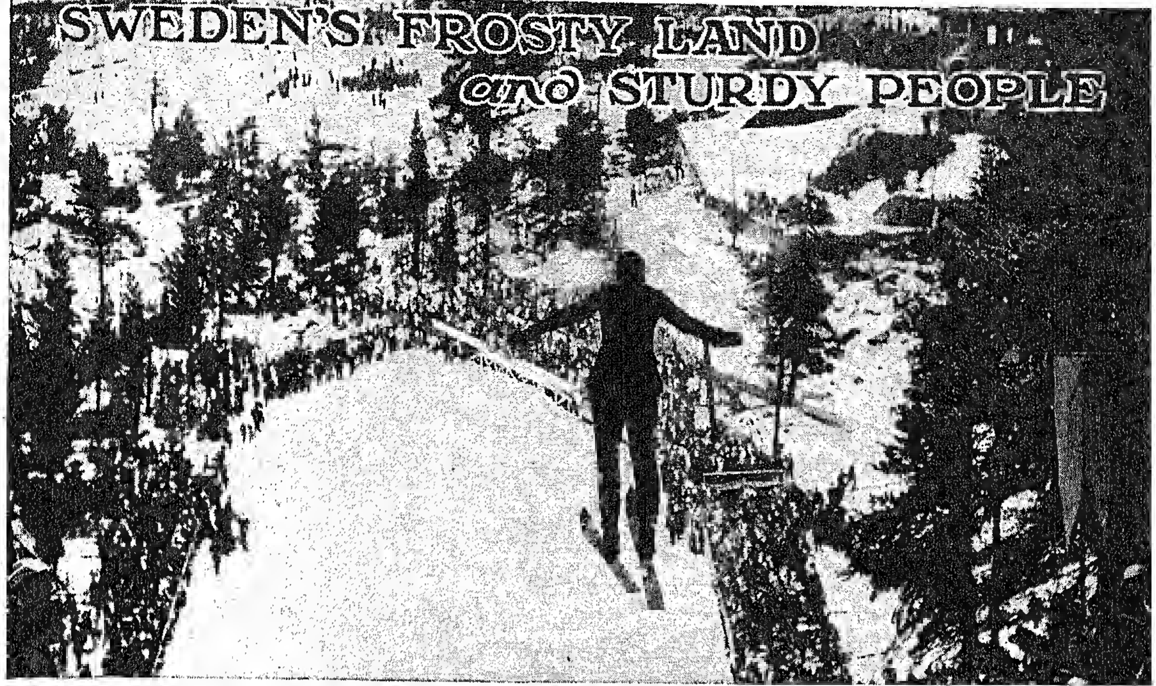
SWEATSHOP SYSTEM. This term is applied to a system under which manufacturing is done under such wretched conditions and for such low wages that the employer is said to "sweat" his employees. The name was given by Charles Kingsley, the English clergyman, sociologist, and writer, who was one of the first to agitate against the abuse. In the United States, 30 per cent of all clothing manufactured in 1892 was made under the sweatshop system.

Sometimes sweatshop work was done in a room hired by the employer. The quarters were often extremely crowded and lacked proper lighting and sanitary arrangements. Sometimes the work was done at home, and then it was called "industrial homework." The materials were often handled by persons who had contagious diseases. Workers often toiled 15 hours a day, seven days a week, at wages so low as barely to enable them to keep alive. Among the chief industries in which "sweating" occurred were the making of garments, cigars, artificial flowers, table favors, lace, candy, and bread.

Such conditions are largely a thing of the past, though they have not been entirely remedied. In addition to regulating work in factories, many states have passed laws regulating industrial homework as well. But enforcement of homework laws is difficult. Another obstacle is that in many trades sweatshop workers have been slow to join trade unions. Under the National Recovery Act of 1934 (which was later declared unconstitutional), certain types of homework were for a while prohibited, in an effort to raise wages and lower hours. But certificates had to be granted to some persons who had to work at home.

The most effective fight against sweatshop methods finally came about through wage-and-hour laws. By 1938, state laws for minimum wage rates were in effect in 22 states. In the same year the federal Fair Labor Standards Act, affecting industries engaged in interstate commerce, attacked sweatshop methods from the wage-and-hour angle. This act was effective in remedying many abuses. It stabilized hours of work and provided for payment for overtime. But in some trades and under conditions not covered by federal or state laws, sweatshop practises still continued.

SWEDEN'S FROSTY LAND and STURDY PEOPLE



Flying without Wings—Ski-Jumping is One of the Favorite Winter Sports in Sweden

Extent.—North to south, about 1,000 miles; east to west, about 250 miles. Area, 173,105 square miles. Population, about 6,250,000.
Natural Features.—Surface in general an undulating plateau falling in terraces from the west to the low Baltic plain on east and south. Chief mountain range the Kjölen (or Keel), which separates Sweden from Norway; highest peak, Kebnekaise (7,005 feet). Many lakes and rivers, occupying together more than 8 per cent of the area. Largest lakes: Wener (2,149 square miles), Wetter, Mälar, Hjelmar. Rivers: Dal, Klar, Ljusne, Tornlo, Kalix, Lule, Skellefte, Ume, Windel.
Products.—Oats, rye, barley, potatoes, sugar beets, wheat, hay, flax; cattle, sheep, goats, reindeer; dairy products; fish; iron, zinc, manganese, lead, coal; iron and steel products; timber, furniture, paper, matches, and other wood products; porcelain, glass, cement; cream separators, ball bearings, telephones, electrical and farm machinery, internal combustion motors.
Cities.—Stockholm (capital), about 500,000; Göteborg, 245,000; Malmö, 130,000; Norrköping, Helsingborg, over 50,000.

SWEDEN. Glistening birches waving like fairy wands against a clear blue lake, set in a lovely landscape of woodlands and rolling pastures; fair rosy-cheeked maidens with long tresses, and tall sturdy lads, all in their gay peasant costumes, singing and dancing in the violet light of the midnight sun; their lilting, haunting melodies—"Sjung hoppsan sa, fallerallala!"—ringing from group to group and echoing from all the hills. These memories are of Sweden's Midsummer's Eve, that gayest of festivals—Midsummer's Day, June 24th—which is a legal holiday in Sweden. All the houses are bedecked with green birch boughs, from Sweden's most beloved tree, and from every village green rises the gaily decorated "May-pole," symbolic of the renewed fertility of Mother Earth.

The short glad summer, coming on the heels of winter in a sudden burst of green, is the busiest time of Sweden's year, for sowing and harvesting must be done in the few brief months before the long dark winter again claims the earth. Sweden lies so far north, one-seventh of it north of the Arctic Circle, that the summers are very short and the winters from seven to nine months long, with very little spring and autumn between. Since the western mountains shut off the tempering winds from the Atlantic, the extremes of temperature are greater than in Norway. The ports on the Gulf of Bothnia are frozen several months in the year, and except in very mild winters navigation is impeded along the northern and central parts of the Baltic. In the far north there are only two or three hours of darkness in summer, and in winter only two or three hours of daylight; and so the people of Sweden can all sympathize with the child in Stevenson's verse:

> In winter I get up at night
> And dress by yellow candle light;
> In summer, quite the other way,
> I have to go to bed by day.

In the very northernmost regions the sun does not set at all for a whole month during the summer, and for a month during the winter it does not rise above the horizon.

In spite of this topsy-turvy arrangement, the Swedes are a happy optimistic people, full of the joy of life, and sturdy and healthy as well. The winter is not a season of gloom for them, for their outdoor sports make it a period of delight. Then the whole country is one vast expanse of hard crisp snow, over which one may glide with incredible speed on sleds or on the long slender skis. All the boys and girls, as well as the older folks, take their daily recreation in this way. The farmer drives his sleigh across the country straight as the crow flies, for all barriers lie buried

deep beneath the snow; and lakes and rivers are frozen deep, offering wonderful opportunities for skating, skiing, and sleighing—sports in which the Swedes are very expert. This bracing winter air is stimulating and healthful, for Sweden's death rate (12.1 per 1,000) is lower than that of many other European countries. The Swedish people also are exceptionally long-lived.

Sweden occupies the eastern and larger part of the Scandinavian peninsula. Its area is about one-third greater than that of Norway and about one-fifth less than that of France. Sweden is separated from Norway on the west by the high plateau of the age-worn Kjölen Mountains from which the land slopes steeply to the east and more gradually to the south. (For map *see* Norway.) Its head, separated from Finland on the north by the Tornio and Muonio rivers, rests beyond the Arctic Circle; its base, nearly 1,000 miles farther south, upon the waters of the Skagerrak, the Kattegat, and the Baltic Sea. On the east the land ends in low, sandy, and often marshy shores along the Gulf of Bothnia, becoming more rocky in the southern part bordering on the Baltic Sea. On the southwestern coast, along the Skagerrak, the Kattegat, and the Sound, low sandy shores alternate with steep cliffs, which, however, are rarely more than 30 feet in height. The entire coast is studded with islands, the largest of which are Öland and Gottland off the southeastern coast. With its enormous coast line, more than 1,400 miles in length, and its many good harbors, it is no wonder that Sweden has large maritime interests and a merchant marine of nearly 3,000 vessels. Herring and other fish abound in the sheltered sounds between the islands and the coast and contribute an important part to the national wealth.

Sweden is divided into three parts or provinces—Norrland, Svealand, and Götaland—which together cover an area of more than 173,000 square miles, and have a population of about 6,250,000. Svealand, in the middle, the original Sweden proper, is the region of great lakes and birch woods, of prosperous farms and flourishing towns, the center of the political and intellectual life. Here is Stockholm, the capital and largest city, with its stately buildings, its splendid harbors, its numerous islands, and its myriad waterways, considered by many the most beautiful capital in Europe (*see* Stockholm). Lovely Lake Siljan, the "Eye of Dalecarlia," one of the beauty spots of Sweden, is in this province. The peasants of Dalecarlia ("the Valleys") still wear their picturesque costumes, and here we must go to see the midsummer festivities in their most charming and romantic setting. A little to the north of Stockholm is the famous university town of Uppsala, the chief seat of learning of the country. In ancient times Uppsala was the seat of the Swedish kings and of the pagan worship of the Norse gods, Odin, Thor, and Freya It now contains the cathedral (begun in the 13th century) of the archbishop of the Swedish Lutheran Church, and the University, founded in 1477. In this same district are the celebrated iron mines of Danemora, where the iron ore is perhaps the best in the world.

Götaland or "Gothland," south of Svealand, was the ancient home of the Goths, those blue-eyed yellow-haired giants of the north who wandered over so much of Europe and whose invasions started the overthrow of the western Roman Empire; thence, too, came many of the vikings who swept the seas in the 9th and 10th centuries. Götaland is the richest agricultural and industrial region of Sweden, fully three-fourths of its area being under cultivation and providing the chief industry of the country; and its frontage on two seas, with its many ports, makes it also the chief

DANCERS IN NATIVE COSTUMES

In Dalecarlia, the "region of dales," about 100 miles north of Stockholm, the peasants still wear the costumes their ancestors wore, speak their own dialect, and preserve their folk dances. The Dalecarlians are known for their gallant spirit, and were the staunchest supporters of Gustavus Vasa in the conflict which freed Sweden from Danish rule.

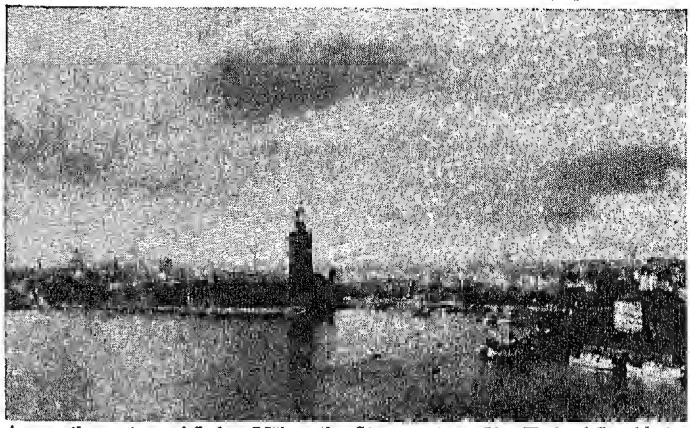
These are Dalecarlian peasant girls in holiday attire. The striped aprons are the most colorful part of this national costume, the stripes usually being bright reds, greens, and yellows, set off by black.

maritime district. Outside of Stockholm, the largest centers of population are in this southern province—Göteborg, Helsingborg, and Malmö on the west coast, Karlskrona and Norrköping on the east coast, are all important cities. Malmö, the third largest city, is almost at the southernmost tip of Sweden and 16 miles straight east across the Sound from Copenhagen, the capital of Denmark.

The chief port of Sweden, and the second largest city, is Göteborg, whose commercial fleet of several hundred steamers carries iron, steel, and timber to the far corners of the earth. The total value of Sweden's exports amounts annually to several hundred million dollars, and a great part of this comes through the port of Göteborg. Here also splendid Swedish liners land direct from New York with their loads of summer tourists and returning Swedish-Americans revisiting the home land. In addition Göteborg is important as a railroad center and as the starting point of the famous Göta Canal, the great and important inland navigation system across southern Sweden, which connects Göteborg and Stockholm.

The scenic route through the Göta Canal, occupying three days' time, is a favorite with tourists. Passing the gigantic and beautiful Trollhättan Falls, and climbing to a height of more than 300 feet above the sea and descending again, by means of 74 great locks, it traverses the great lakes of Sweden — Wener, Wetter, and Mälar—between beautifully wooded hills and lovely pastures, with here and there an ancient castle, a picturesque red farmhouse, or a tiny village.

THE CITY HALL IN STOCKHOLM



Across the waters of Lake Mälar the Stadhuset, or City Hall, of Stockholm looks like an ancient castle. But the last of its new bricks was laid in 1922, and it is a fine example of modern Swedish architecture.

But the Göta Canal is not merely a scenic route; it is a great artery of Swedish commerce, through which pass many thousands of vessels each year.

Norrland, north of Svealand, is larger than the two other provinces combined. This is a region of great virgin forests, of high mountains, and considerable rivers, whose vast wealth in timber, iron ore, and water-power has only recently been developed. Here is Kiruna, more than 100 miles north of the Arctic Circle, a flourishing mining town with excellent schools, libraries, art exhibits, electric lights and trolley cars, which a few years ago was not even on the map. Here we sometimes see an encampment of Lapps with their herds of reindeer, though usually these queer timid people, who live in their reindeer tents the year around, will avoid the cities as much as possible, coming in only to trade their reindeer skins and hand-carved spoons and knives of horn for such necessary articles as sugar, flour, salt, and coffee (*see* Lapland). Close by Kiruna is Kirunavara, a mountain of iron which yields millions of tons of the finest ore each year. Since Lulea, the port on the Gulf of Bothnia, is closed

THE CHILDREN TAKE CARE OF THE LIVE STOCK

Many of the shepherds and goatherds of Sweden are young girls who are not strong enough to do heavy farm work. In almost every bit of pasture the traveler will find a youthful herder, serious and intent on her task. Goat's milk was formerly a staple food among the peasants, but cow's milk is now more commonly used, and herds of goats are not as large or as numerous as they once were.

by ice during the winter months, most of this ore is sent by electric railroad over the mountains to the open Atlantic port of Narvik in Norway, whence it is shipped to all parts of the world.

Excellent railroads connect these far northern parts with the southern provinces, and at Boden, near the Finnish border, is the important junction with the Finnish railroad. Being the military key to northern Scandinavia, Boden is strongly fortified; through this junction, at the outbreak of the World War in 1914, passed thousands of refugees of all nations, fleeing to their homes.

The many rivers of Norrland all rise in the mountains on the Norwegian border and extend in almost parallel lines east to the Gulf of Bothnia. Most of them are deep and navigable for more than 100 miles from the sea; they furnish excellent means of transportation for the timber cut on the mountains.

Wealth Drawn from Natural Resources

The forests of Sweden cover 60 per cent of the total area of the country; and the timber products—lumber, wood pulp, paper, artificial silk, furniture, matches, and others—form the basis of several of the largest and most progressive Swedish industries. In exports of these products Sweden ranks among the foremost countries of the world. An intensive program of reforestation is carried on by the government, and annual timber consumption is limited to the amount of natural growth.

Sweden is particularly rich in minerals. Besides the iron beds, which yield great quantities of the finest and purest ore, there are deposits of copper, zinc, manganese, sulphur pyrites, lead, and silver; and paving stone is an important product of the quarries. In addition to the production of iron and steel, there are important metal industries producing cream separators, ball bearings, telephone supplies, lighthouse apparatus, motors, and electrical machinery. Porcelain and glass factories turn out many fine wares. Shipbuilding is a growing industry.

Hydroelectric Development

For a long time Sweden's poverty in coal retarded the growth of its mining and manufactures, but this handicap has been partly overcome by harnessing the abundant water power furnished by the numerous rivers. The current for central and southern Sweden is supplied chiefly by power stations at Trollhättan, Älvkarleby, Västeras, and Motala. Beyond the Arctic Circle the great hydroelectric plant at Porjus supplies current for iron ore mining, for the electric railway from Lulea on the Baltic to the Norwegian port of Narvik, and also for the homes of Kiruna. In almost every part of Sweden this "white coal" operates factories, sawmills, and trains, and the Swedish farmer uses it to drive his threshing machine, milking machine, and for many other operations. He has even put it to work heating the soil for the forced cultivation of vegetables.

In spite of the increase in manufacturing and other industries, more than 40 per cent of the people are still engaged in agriculture, "the mother industry." Little of the land is suitable for cultivation, only about ten per cent being under crop. Oats, wheat, rye, and barley are the principal cereals. Hay, potatoes, and sugar beets are grown in quantities, and sugar refining is increasing. Much live stock is raised, and butter and bacon are exported.

Both the fresh- and salt-water fisheries of Sweden are important. Salmon, pike, trout, char, and perch abound in the lakes and streams, and herring, cod, flatfish, mackerel, and sprat are caught in the Baltic.

Education in Sweden is free and compulsory for all children from 7 to 14, and there are excellent schools and colleges. Besides the State University at Uppsala and the State University at Lund, there are other institutions of higher learning at Stockholm and Göteborg. The Swedes are a highly cultured people, delighting in art, literature, and music. They have a special aptitude for scientific pursuits, and have produced some famous scientists; the best known are perhaps Linné (Linnaeus), the botanist famous for his classification of plants and animals, and Alfred Nobel, the inventor of dynamite, who left his fortune to establish five annual prizes to those who contribute the greatest service to mankind in the fields of physics, chemistry, medicine, literature, and peace (*see* Linné, Carl von; Nobel Prizes).

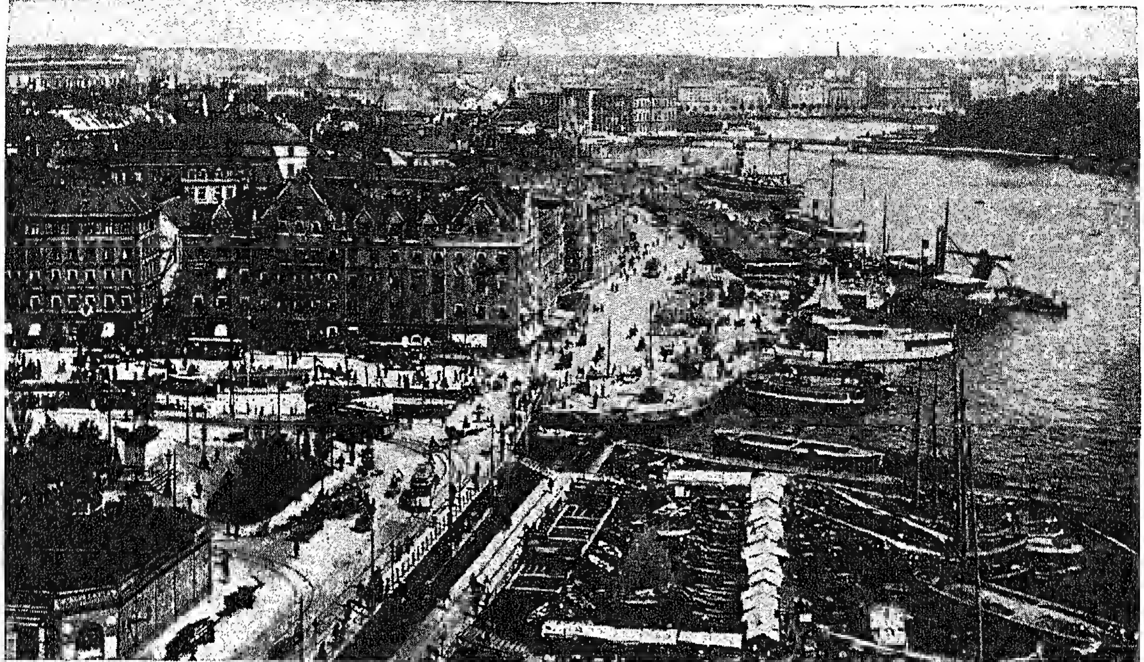
In 1909 Sweden granted the suffrage, without restrictions as to property or income, to all men 23 years old or over; and ten years later the same privilege was extended to women. Sweden is famous for the "Göteborg system," under which the manufacture and sale of intoxicants are in the hands of municipalities, with the design of checking their excessive use. The government is a limited hereditary monarchy, with a king, a cabinet, and a parliament or *Riksdag* consisting of an upper chamber of 150 members and a second chamber of 230 members. For administrative purposes the country is divided into 24 *län* or provinces. As in the other Scandinavian countries, Lutheranism is the state religion. More than 99 per cent of the people belong to the state church, but other religions are tolerated. (*See also* Scandinavia.)

Sketch of Sweden's History

The history of early Sweden is found chiefly in its many sagas—legends and tales of heroes. Like Denmark and Norway, the land was first organized as a state by the Scandinavian "Northmen," who were the terror of Europe in the 10th century (*see* Northmen). Christianity was not fully established until the 11th century.

The able political genius, Margaret, regent of Denmark and Norway, brought Sweden under her sway by the Union of Kalmar in 1397. Under the oppression and misrule of her successors, the Union weakened and almost fell apart. Both Norway and Sweden were enjoying almost complete independence when Christian II came to the throne in 1520. This mighty king decided to unify his kingdom by striking a blow

STOCKHOLM, "VENICE OF THE NORTH"



Although Stockholm has often been called the "Venice of the North," because it is built partly on islands, there is little in its appearance to suggest the island city of Italy. Stockholm's islands are rocky and wooded, with narrow quiet waterways between them. The photograph shows the northern part of Staden, the ancient nucleus of the city, now an island in the central part. In the distance, on the left bank of the river, is the great rectangular pile of the Royal Palace, a handsome building in the style of the Italian Renaissance, a strange link between this cold Scandinavian Venice and its sunny sister city of the south.

at the powerful Swedish nobility and thus securing the support of the peasantry. With savage perfidy, he lured the nobles to an assembly at Stockholm, and brutally slaughtered them. For two days the streets ran with blood.

The Revolt of Gustavus Vasa

This gruesome episode, known as the "Blood Bath of Stockholm," aroused the patriotism of the peasants, and under the fiery leadership of Gustavus Vasa they threw off the Danish yoke. This energetic young nobleman, whom Christian II had imprisoned, escaped from Denmark and returned in 1520 to Sweden, where he learned that his father and brother-in-law had been killed in the Stockholm Blood Bath. Roused to vengeance, he moved through Dalarna (Dalecarlia) and other provinces, and without money or arms assembled his peasant troops. Vanquishing the Danish garrisons sent to meet him, he marched to the very gates of Stockholm and stormed the city, but his poorly equipped soldiers were easily repulsed. Then came the news that the Danes themselves had ousted Christian from the throne. At once the Danish army vacated Stockholm and left the city to Gustavus Vasa, whom the Swedes elected king on June 6, 1523.

Out of an impoverished country King Gustavus created a new Sweden. A break with the pope resulted in the establishment of Lutheranism as the state religion, and the ecclesiastical wealth and the magnificent castles of the bishops were seized by the state. Gustavus restored order to the administration, subdued repeated uprisings among the peasants, and personally supervised the development of agriculture, mining, and trade. During most of his reign he ruled absolutely alone, trusting not a single person with even minor duties. At his death in 1560 he left Sweden a real power in Europe, with a full treasury and a well-equipped army and navy.

Eric XIV, his eldest son, succeeded Gustavus. During the eight-year rule of this ostentatious, wilful, and insane king much of his father's constructive work was destroyed. Eric was finally dethroned and imprisoned. His equally irresolute brother, John III, continued the work of national disintegration and attempted the restoration of the Catholic church in Sweden. Four years later John's son Sigismund mounted the throne. Sigismund, also a Catholic, had acquired the Polish crown by marrying a Polish princess, and Polish domination so roused the national spirit of the Swedes that, led by Charles Vasa, the king's uncle, they revolted. Sigismund was deposed, and his uncle received the crown as Charles IX. Charles reëstablished Protestantism and continued the constructive work of Gustavus Vasa, but on his death in 1611 he bequeathed to his illustrious son, Gustavus Adolphus, the rule of a country entangled in wars with Russia, Poland, and Denmark.

Reign of Young Gustavus

The 17-year-old Gustavus, already a brilliant scholar, administrator, and general, was fitted for his task. From childhood he had been trained to be

king, and had fought great winning battles with the Danes. First the young king concluded the war with Denmark, so that he might be free to deal with Russia and Poland. By the treaty at Stolbova in 1617, he took possession of the Russian territory on the Baltic, securing for Sweden a firm foothold on this important sea. The war with Poland was not concluded until 1629. Next, he championed the Protestant cause in Germany in the Thirty Years' War, but after a series of successful battles he was killed in the battle of Lützen in 1632, leaving Sweden one of the leading military powers in Europe. (*See* Gustavus Adolphus.)

By the treaty of Westphalia in 1648, which concluded the Thirty Years' War, Sweden secured western Pomerania, Wismar, the archbishopric of Bremen, and the bishopric of Verden, and obtained primacy of the Baltic and a foothold on the North Sea.

The crown now fell to Christina, the six-year-old daughter of Gustavus Adolphus, and, until she was 18, the government remained in the expert hands of Axel Oxenstjerna, her father's famous chancellor. Christina encouraged mining, manufacturing, and trade. Noted scholars, philosophers, and artists crowded her luxurious court. Yet this brilliant and educated queen squandered the state wealth on her favorites, and worried her subjects by her silly foreign policies. After a ten-year rule she abdicated in favor of her cousin, Charles Augustus, and, disguised as a count, fled to Italy, where she became a Catholic.

Her cousin, Charles X, the Pyrrhus of the Swedes, plunged into wars with Denmark and Poland, ambitiously intent upon making the Baltic a Swedish sea. His daring and brilliant military exploits were ended abruptly by his early death in 1660. His son, Charles XI, struggled valiantly in his long reign to save the Swedish power, but the collapse came during the reign of the next king, Charles XII. For a time this boy king held off his enemies, Russia, Poland, and Denmark, but in 1709 Sweden lost its ascendancy when Peter the Great defeated Charles decisively at Poltava (*see* Charles XII). By the Peace of Nystad (1721) Sweden lost most of its prized possessions on the eastern shores of the Baltic. Finland also was lost (1809), in a disastrous war with Russia. By the Peace of Kiel (1814), Norway was taken from Denmark and placed under the Swedish king (*see* Norway), but in return Swedish Pomerania went to Denmark.

The present ruling house of Sweden stems from Bernadotte, one of Napoleon's marshals, who was elected crown prince in 1810. In 1905 Norway severed its connection with the Swedish crown and chose its own king. In 1907 Gustavus V ascended the throne. During his reign Sweden further advanced its celebrated program of social reform, so that the nation became known as "one of the most civilized in Europe." Both its long record of peace and its many reforms were imperiled, however, by German expansion in the second World War. (*See also* World War, Second; and **Sweden** in FACT-INDEX at the end of this volume.)

—REFERENCE-OUTLINE *for Organized Study of* SWEDEN *and* NORWAY—

THE SCANDINAVIAN peninsula, occupied by Sweden and Norway, is virtually an island in the commercial and economic sense. The neck of land that connects the peninsula to the European mainland is so remote in its arctic isolation that it has little practical value as a link with the rest of the world. It is, in fact, an almost unused back door. The front door is the sea. The features which distinguish Sweden and Norway from each other can be traced largely to differences between the seas which they face. Norway, exposed to the tempering winds from the North Sea, has on the whole a warmer, moister climate than Sweden, despite the fact that Sweden is farther south. The Baltic Sea harbors of Sweden are usually ice-locked through the winter, while most of the Norwegian seaports, snuggled in the deep fiords, are ice free the year round.

While this makes Norway a more important seafaring nation than Sweden, the excessive rains combined with the poor soil keep its agricultural development far behind that of Sweden. The two countries, however, are closely related by race and tradition. The people of the Scandinavian peninsula are conspicuous among the nations for their thrift, vigor, and progressiveness.

Sweden

I. POSITION, PHYSIOGRAPHY, AND CLIMATE: S-335, S-336, S-337, S-338, N-173 map. Baltic Sea B-32; Lapland L-64; North Sea N-170; Scenery S-337.

II. RESOURCES AND INDUSTRIES:

A. Agriculture: S-336, S-337 picture, S-338.

B. Manufacturing: S-338, S-290. Water Power S-338.

C. Mining: S-336, S-337, S-338, I-138.

D. Forestry: S-337, S-338.

E. Fisheries: S-336, S-338, F-81, S-13.

F. Shipping: S-129, S-336. Chief Port S-336–7.

III. CHIEF CITIES: S-336–7. Stockholm (capital) S-289; Göteborg S-337; Malmö S-337.

IV. TRANSPORTATION: Railroads S-337, S-338; Rivers S-338; Canals S-337, S-289.

V. THE PEOPLE, THEIR CHARACTERISTICS AND CUSTOMS: S-335–6, S-337.

A. Race and Language: S-36.

B. Holidays and Festivals: S-289–90, S-335, S-336 picture, H-322–3, F-135. Play and Games P-247, P-248–9, P-250, P-254 picture, P-255 picture. Sports W-116, S-335–6.

C. The Lapps: S-337, L-64, N-177 picture.

VI. EDUCATION: S-336, S-338, S-290.

VII. CONTRIBUTIONS TO ART, SCIENCE, LITERATURE: S-338, S-36, D-96, D-98. Linné L-148; Alfred Nobel N-148.

VIII. HISTORICAL HIGH LIGHTS: S-338–40.

A. Country Organized by the Northmen: S-338, N-166.

B. Christianity Established in the 11th Century: N-168.

C. Conquest of Finland: F-44.

D. Union of Sweden, Norway, and Denmark: N-178, S-36.

E. Christian II and the Blood Bath of Stockholm: S-290.

F. Freedom from Denmark: S-339, D-53.

G. Gustavus Adolphus II: G-189. Thirty Years' War T-80.

H. Position After Treaty of Westphalia: T-81, E-323.

I. Waning Power Under Christina, Charles X, and Charles XI: S-340.

J. Charles XII and His Losing Wars: C-154, P-143.

K. Sweden in the Seven Years' War: S-84.
L. Sweden in the Napoleonic Wars: N-8, N-9.
  a. Loss of Finland: F-44.
  b. Bernadotte Starts Ruling House (1810): S-340.
  c. Norway Joined to Sweden (1814): D-53, N-178, S-340.
M. Norwegians Dissolve the Union (1905): N-178, S-340.
N. Progressive Legislation Passed: S-338, S-340.
O. Peace and Independence Menaced by European War Beginning in 1939: S-340.

IX. GOVERNMENT AND RELIGION: S-338, S-339.

Norway

I. POSITION, PHYSIOGRAPHY, AND CLIMATE: N-171–4, N-173 map. Lapland L-64; Fiords P-198; North Sea N-170; Land of the Midnight Sun S-328 picture, N-176.

II. RESOURCES, INDUSTRIES, AND PRODUCTS:
A. Agriculture: N-172, N-175 pictures, N-176.
B. Manufacturing: N-178, O-252. Water Power N-177 picture.
C. Mining: N-176, N-178.
D. Fishing Industry: N-173 map, N-174, N-176, N-177 picture, N-178, S-13, W-78 picture, F-79, F-81.
E. Forestry: N-178, O-252.

III. TRANSPORTATION AND COMMERCE: N-174, N-176, N-178, O-252, S-129.

IV. CHIEF CITIES: N-172, N-174, N-176. Oslo (capital) O-252, N-177 picture; Bergen N-177 picture (Fact-Index); Trondheim, Stavanger (Fact-Index); Hammerfest N-176.

V. THE PEOPLE, THEIR CHARACTERISTICS AND CUSTOMS: N-172, N-174, N-177 picture.
A. Race and Language: S-36.
B. Holidays and Festivals: H-322-3. Sports N-172, N-174 and picture, W-116.
C. Houses: N-174, N-175 picture, N-177 picture.
D. Lapps: L-64, N-177 picture.

VI. EDUCATION: N-172 picture, N-176, N-178.

VII. HISTORICAL HIGH LIGHTS: N-178.
A. Home of the Vikings: N-166.
B. Formed into a Kingdom in the 10th Century: N-178.
C. Canute: C-79.
D. Discoveries and Colonization: N-166. Greenland Settled G-176, N-168; Iceland Colonized I-4, I-6, N-168; North American Coast Touched A-141, N-168.
E. Kingdom Formed and People Christianized (10th–11th Centuries): N-178, S-338.
F. Union of Kalmar with Sweden and Denmark: S-338, S-36.
G. Charles XII of Sweden Invades Norway (1718): C-154.
H. Peace of Kiel (1814) Takes Norway from Denmark and Gives It to Sweden: S-340, D-53, S-36.
I. Norway Separates from Sweden and Chooses Prince Charles of Denmark to Rule as Haakon VII: N-178.
J. Norway Invaded by Germany and, after Brief Resistance, Occupied by German Army in 1940: N-178.

VIII. GOVERNMENT AND RELIGION: N-178.

IX. LITERATURE: S-36. Björnson B-152; Ibsen I-2.

Bibliography for Sweden and Norway

—Books for Younger Readers:
Brock, E. L. At Midsummer Time (Knopf, 1940).
Hall, J. O. When I Was a Boy in Norway (Lothrop, 1921).
Hertzman, A. M. When I Was a Girl in Sweden (Lothrop, 1926).
Lagerlöf, S. O. L. Memories of My Childhood (Doubleday, 1934).
Olcott, Virginia. Olaf and Ane (Vanguard, 1938).
Riis, J. A. Hero Tales of the Far North (Macmillan, 1915).
Smith, S. C. G. Made in Sweden (Minton, 1934).
Zwilgmeyer, Dikken. What Happened to Inger Johanne (Lothrop, 1919).
—Books for Advanced Students and Teachers:
Childs, M. W. Sweden, the Middle Way (Yale Univ. Press, 1936).
Franck, H. A. Scandinavian Summer (Appleton-Century, 1930).
Gjerset, Knut. History of the Norwegian People (Macmillan, 1932).
Hambro, C. J. I Saw It Happen in Norway (Appleton-Century, 1940).
Harriman, F. J. Mission to the North (Lippincott, 1941).
Rothery, A. E. Sweden, the Land and the People (Viking, 1934).
Svanstrom, Ragnar and Palmstierna, C. F. Short History of Sweden (Oxford, 1934).

SWEET PEA. No summer garden is really complete without the fragrant many-colored butterfly blossoms of

> Sweet peas on tiptoe for a flight
> With wings of gentle flush o'er delicate white.

And because of their beauty and fragrance and the ease with which they may be cultivated they are general favorites in greenhouses as well.

Sicily and far-away Ceylon are the native lands of our present garden race of sweet pea. An old Italian monk was its first cultivator, the story goes, and somewhere around the year 1699 sent seeds of it to England and elsewhere. In the last part of the 19th century English florists experimented with the plant and bred many varieties of beautiful colors and remarkable size. Later still America began experimenting, too, and owing to the successful work of California seed-growers, who produce most of the world's supply, the number of named varieties is now legion.

The sweet pea's scientific name is *Lathyrus odoratus;* it belongs to the pea family *Leguminosae.* The blossom has 5 petals; the upper or odd one, which is larger than the others and incloses them in the bud, is called the standard. Stem rough, hairy; pods from 1 to 2 inches long.

SWEET POTATO. On the world's dinner table the sweet potato is the vegetable ranking next in importance to the white or Irish potato. (*See* Potato.) It produces more pounds of food to the acre than any other plant and ranks next to corn in the amount of nourishment to the acre it provides. Though probably native to America, it is now widely grown in other tropical and warm countries. North Carolina, Mississippi, Alabama, Georgia, and Louisiana produce more than half the United States crop.

Unlike the white potato, it is a creeping perennial vine, related to the morning-glory, and its tubers are not underground stems but true roots. It is a more nutritious food than the white potato, being richer in proteins, sugars, fats, and vitamins.

The plant thrives best in a warm climate, but it can be grown wherever there is a growing season of four months free from raw winds and frost. The best soil for it is well-drained, loose, sandy loam. New plants are obtained by planting slips in hotbeds or outdoor beds and transplanting them about a month later. One bed usually yields three sets of sprouts.

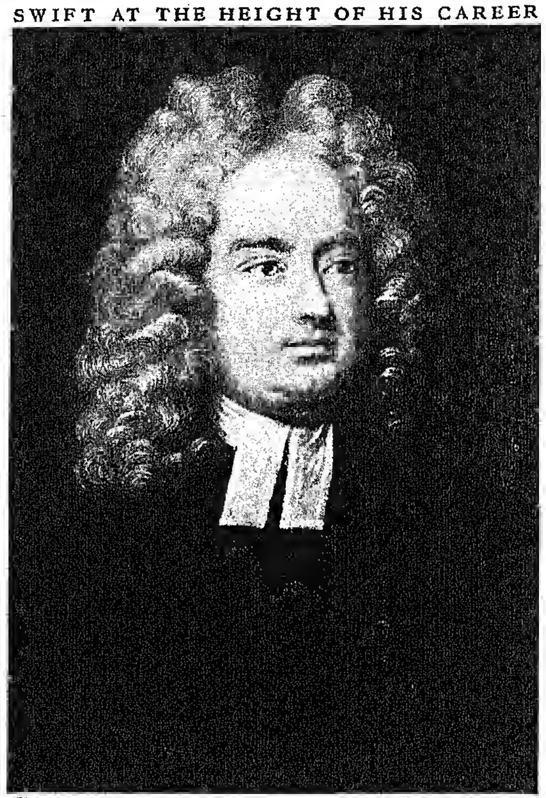
Sweet potatoes of the yellow-fleshed variety are called yams in the South, but the true yam is a root tuber belonging to a different family. It is grown in Asia, Europe, and the West Indies, but not to any great extent in the United States. The roots of some varieties weigh 30 pounds or more.

Scientific name of the sweet potato, *Ipomoea batatas.* The yam is any one of several species of *Dioscorea.*

SWIFT, *the* UNHAPPY GENIUS *Who* CREATED GULLIVER

SWIFT, JONATHAN (1667–1745). When Swift wrote 'Gulliver's Travels,' he intended it for a satire on mankind. He proposed, in his own words, "to vex the world rather than divert it." But mankind, untroubled by the satire, enjoyed the story and gave it to children to read. And today most readers know this ferocious indictment of human nature only as an amusing tale for children.

SWIFT AT THE HEIGHT OF HIS CAREER



This portrait of Swift at 42 shows him as he was in the years when he was one of the best-known men in London. He is wearing the fashionable periwig of the 18th century and the clerical black gown with white bands.

From early youth, Jonathan Swift was bitter and resentful. Born after his father's death, he was dependent upon an uncle who was, the boy thought, ungenerous. At six the orphan was separated from his mother, who went back to live in England while he was sent to Kilkenny School, "the Eton of Ireland," where he spent eight years. As a student he was not notable, and he seems to have made no close friendships. Nor was he either industrious or happy at Trinity College, Dublin, to which he was admitted in 1682. After taking his bachelor's degree four years later, he remained there three years more, though not quite long enough for a higher degree. Contemptuous of the subjects required of him, he devoted his time to reading history and poetry for his own pleasure, stayed away from lectures and chapel, and amused himself with companions in town.

England then ruled Ireland like a conquered province, and the English Swifts had recently come there to make their fortunes. The Revolution of 1688 made the English feel insecure, and Jonathan Swift left college the next year for England. Being a gentleman, he could not, by the old aristocratic code, go into business, and there was then no profession available to him. Through his uncle he was introduced to Sir William Temple, a retired Anglo-Irish statesman. Swift became a secretary to Temple and lived, with intervals elsewhere, at Temple's house for ten years.

Although Temple was on the whole kind to him, Swift could never forget that he was a dependent. His chief comfort in his galling situation was his friendship with a child, Esther Johnson, whose mother was companion to Temple's widowed sister. When Swift first met Esther she was only eight, 14 years younger than he. He taught her to read and write, and as long as she lived she was his closest friend, known since to the world by the nickname Stella which he gave her.

Clergyman, Wit, and Journalist

During the first years with Temple, Swift wrote a few poems which the poet Dryden, Swift's cousin, is said to have told him were not good—as they were not. Swift turned bitterly from poetry, which in any case he did not think of as a profession. He might have become a lawyer or a soldier, or might have had a minor post in a government office. Instead, he went to Ireland in 1694, entered the church, and was sent to a rural parish near Belfast. This bored him, and he was soon back with Temple. But now Swift knew he had a profession, and he was more assured about his future. Between 1696 and 1697 he wrote his first important satires, 'A Tale of a Tub' and 'The Battle of the Books', but did not publish them until 1704.

Temple died in 1699 and Swift returned to Ireland, to which Stella soon followed him. Again Swift was assigned to a country vicarage. It was a small parish, and the story is told that once when the sole member of his congregation was the parish clerk, Swift began his sermon: "Dearly beloved Roger—." He was free to leave his parish in charge of a curate and spend much of his own time in Dublin or London. As a clergyman he regarded himself more or less as a soldier holding a garrison against the enemy. But when there was no immediate danger, or when there was work to be done elsewhere, he did not hesitate to turn his post over to subordinates. What took him to London was a mission from the Irish Church, to obtain certain benefits from Queen Anne. What kept him there was partly his duties as lobbyist, partly his efforts to obtain a higher appointment in the church for himself, and partly his friendship with the wits of London, where 'A Tale of a Tub' made him quickly famous. Addison and Steele were his daily companions. He wrote papers for *The Tatler* and took part in hoaxes that made all London laugh.

Heretofore Swift had been, like Steele and Addison, a Whig, but in 1710 he went over to the Tories, chiefly

because he thought they had the interests of the church more at heart than the Whigs would ever have. This led to his employment by the Tory ministry which had just come into power. The principal aim of the Tories was to put an end to the long war with France, which had been undertaken by the Whigs, and waged by their great general, Marlborough. The Tory ministers set themselves to destroy the power of the Whigs, get rid of Marlborough, and bring about peace. They managed the necessary political intrigues, and used Swift to influence public opinion by his writings.

An Anonymous Pamphleteer

In the Tory *Examiner* and in pamphlets and verse he carried on a blasting campaign against Marlborough for his greed, and against the Whigs for their fanatical refusal to consider the interests of Britain as a whole. In all this Swift wrote anonymously. He wanted to win his point, not serve his personal reputation. He no more cared what became of such writings after they had done their work than a hunter cares what becomes of his bullets after they have brought down his game.

Alienated by politics from Addison and Steele, Swift now made new literary friends among the Tories: the witty and spiteful Alexander Pope; John Gay, author of 'The Beggars' Opera'; and John Arbuthnot, physician to Queen Anne. With some others they formed the Scriblerus Club which met every Saturday night. Together they planned to write the burlesque memoirs of the imaginary Martinus Scriblerus, to ridicule false learning. Though this was barely begun and outlined, it was the seed of 'Gulliver's Travels'.

Marlborough was recalled and the war ended with the treaty of Utrecht in 1713, but the Tory ministry did not last. After the Queen's death in 1714 the Whigs regained their power, under the Hanoverian King George I. Swift throughout his period of influence had hoped he might become a bishop. But he had too many enemies, and his friends did no more than make him Dean of St. Patrick's Cathedral in Dublin.

During these years of daily association with the great, Swift sent Stella in Dublin a day-by-day account of everything he did. This 'Journal to Stella', written with no thought of publication, is a fascinating record not only of Swift's life but of London society and politics in the reign of Queen Anne.

Exile and Patriot

Although Swift is now thought of as one of the supreme Irish patriots—and was—he returned to Ireland as to a place of exile. London had been the scene of his successes. The men he liked best were there. In Ireland he was out of the world in which he had come to feel at home. Dublin had no poets like Pope, no wits like Arbuthnot. For ten years Swift took almost no interest in anything. His one confidante was Stella, who with a companion lived always near him.

When he emerged from his silence it was again as an enemy of the Whigs. But now he attacked the Whigs as Englishmen misgoverning Ireland. In 1724 he wrote his 'Drapier's Letters', rallying the Irish with arguments that sometimes anticipate those later used by the American colonists before the Revolution. In 1729 he published the most terrible of his satiric pamphlets, 'A Modest Proposal'—that the people of Ireland eat their children as the only way to keep England from starving them all to death. And so for the rest of his life he defended the Irish cause with a force and wit that went a long way to uniting Ireland and that made England cautious.

After 1720 Swift again took up the Scriblerus memoirs which he and his friends had planned in London, and by 1725 he had finished 'Gulliver's Travels'. The next year he visited London, where he had the happiest time with Pope, Gay, and Arbuthnot, and where he left his book to be published. Because of the political satire in it, the manuscript was sent secretly to the printer, and the book appeared without Swift's name. But it was known to be his, and it instantly became popular. In 1727 he visited London again. Thereafter he lived in Ireland, often homesick for England but gradually settling himself into a life which had turned out better than he expected. After Stella's death in 1728 he was very lonely, in spite of his devoted friends. He had suffered since his young manhood from attacks of deafness and giddiness. These became worse, and finally unendurable, and for the last three years of his life he was insane. He died Oct. 19, 1745, and was buried in St. Patrick's beside Stella. Over his grave was carved the epitaph he wrote for himself, with the famous line: *Ubi saeva indignatio ulterius cor lacerare nequit*—"Where furious indignation can no longer eat into the heart."

'Gulliver's Travels'

'Gulliver's Travels' (1726), one of the most famous of books for children, was not written for children at all. It was savage satire aimed at the entire human race. Swift was more than a merely disappointed man. By nature morbidly fastidious, he had an instinctive antipathy to mankind at large because of its vice, folly, stupidity, and uncleanness. His 'Gulliver's Travels' was his arraignment of the world.

The strange countries which Gulliver visits were, for Swift, much like the countries he knew. The tiny Lilliputians are as vain, malicious, and bloodthirsty as ordinary men. Readers of the book in Swift's day saw in the king and the court of Lilliput a parody of the English king and court. The giants of Brobdingnag are amiable, but they are commonplace and insensitive. Laputa is full of the foolish philosophers and scientists that Swift despised. And the Houyhnhnms are horses who use degraded men, Yahoos, as men use horses elsewhere. This fourth voyage of Gulliver marks the peak of Swift's satire. Looking at mankind through the eyes of horses, he sees it as vicious, greedy, ignorant, and filthy. Beasts are better.

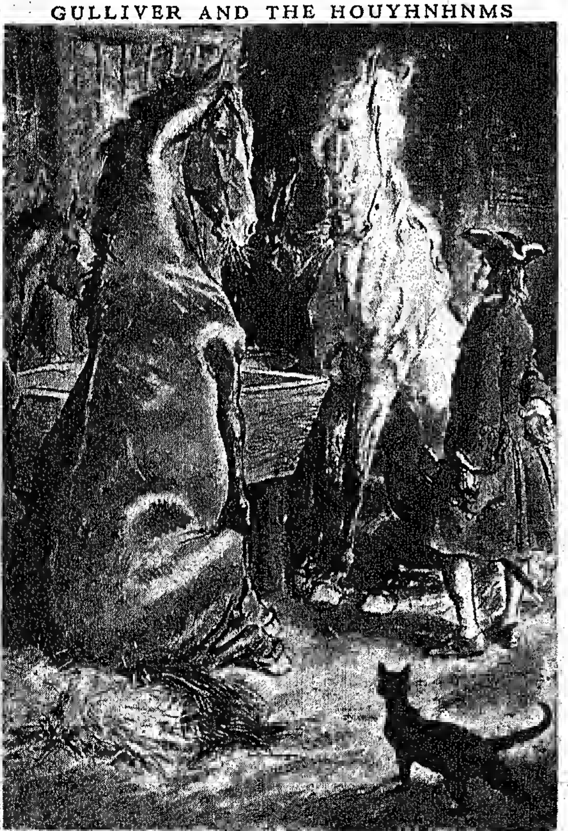
Satire aimed at all men is taken to heart by none of them. 'Gulliver's Travels' from its first appearance delighted the world instead of shocking it. The satire was lost in the story. In spite of his misanthropy, Swift took a dry delight in making his narrative so

circumstantial that it would sound real even when it was most fantastic. Adults might catch the cold implications of the book, but children, quite unaware of them, could breathlessly enjoy the marvelous adventures of a traveler among pigmies and giants, on a flying island, in a topsy-turvy country where horses talk. 'Gulliver's Travels' was soon a classic for children, and has been that ever since. This has had an ironical result. Most people, having read the book in childhood when the satire meant nothing to them, do not know there is anything in it but the story. They think they have read it when in a sense they have not. One of the best-known books is actually one of the least known. One of the most disillusioned books is thought of as a tale of illusion.

Other Writings

Swift was a very great writer who usually wrote to affect public opinion at the time. A large part of what he wrote is made up of pamphlets on political or ecclesiastical affairs, and must be read in the light of history. But 'A Tale of a Tub', a satire on false religion, and 'The Battle of the Books', a burlesque of literary controversy (both published in 1704) are still read for their comic ridicule of human folly. In his 'Drapier's Letters' (1724), written to expose a minor scandal in the government of Ireland by the English, Swift lifted the issue to something universal, the human rights of men against tyrants. In 'A Modest Proposal' (1729) is a voice speaking for an outraged nation. Swift seems often to have done more than he knew he was doing. The 'Journal to Stella' is only a diary written for a friend, but it is also a brilliant picture of London in one of its brilliant ages. The 'Verses on the Death of Doctor Swift' (1739) he wrote as a kind of joke, to tease his friends, but it is almost unbearably heartbreaking. It is laughter and anguish in the simplest speech.

GULLIVER AND THE HOUYHNHNMS



One of Gulliver's voyages took him to the country of the Houyhnhnms (pronounced *whin'mz*), a race of intelligent horses. These happy and virtuous animals are served by the disgusting Yahoos, who are apish caricatures of humanity.

THE INHABITANTS OF LAPUTA

On another voyage Gulliver visited the Flying Island of Laputa and the topsy-turvy continent of Lagado. In these mad lands few talk sense, and the "wise men" are engaged in such fantastic projects as extracting sunbeams from cucumbers.

Both in verse and prose Swift's chief qualities are intensity and directness. A man of vehement emotion, he had absolute lucidity of mind. Nothing that he wrote is ever cloudy or feeble or flat. The force of a burning poet is behind his words, but the words themselves are plain and blunt. In the contrast lies the secret of his power.

Editions and Biographies

The best collected edition of Swift is that of the prose in 12 volumes edited by Temple Scott (Macmillan, 1897–1908) with two additional volumes of verse edited by W. E. Browning (1910). Swift's correspondence has been edited in six volumes by F. Elrington Ball (Macmillan, 1910–14). All these are out of print. The best editions of important individual works are: 'A Tale of a Tub' (Oxford, 1920, edited by A. C. Guthkelch and D. Nichol Smith); 'The Drapier's Let-

ters' (Oxford, 1935, edited by Herbert Davis); 'Poems' (3 vols., Oxford, 1937, edited by Harold Williams); 'Gulliver's Travels' (First Edition Club, 1926, edited by Harold Williams). Two volumes of selections are valuable: 'Swift: Gulliver's Travels and Selected Writings in Prose and Verse' (Random House, 1934, edited by John Hayward) and 'Satires and Personal Writings' (Oxford, 1932, edited by W. A. Eddy) —this last does not contain 'Gulliver'. The standard biography is that by Sir Henry Craik (1882 and 1894). There are briefer biographies by Sir Leslie Stephen (1882), John Churton Collins (1893), Carl Van Doren (1930), and Ricardo Quintana (1936, with an up-to-date bibliography.)

SWIMMING. It is said that all living creatures, except men and monkeys, can swim by instinct. But, in this respect, men have one advantage over monkeys—they can learn as an art what they lack as an instinct. Any normal human being can acquire the art in a short time, if he sets about learning it in a proper manner.

The first thing to remember is that the average human body, when there is air in the lungs, is slightly lighter than fresh water, and considerably lighter than salt water. Nearly everyone can "float" motionless on the back, if the body is properly balanced.

The most important step in learning to swim is to acquire the right method of breathing. Swimmers inhale through the mouth. They exhale through either the mouth or nose, or through both mouth and nose. Coaches often instruct pupils to inhale deeply and quickly, but to exhale more slowly. To accustom yourself to breathing this way, go into water up to your hips, inhale deeply through the mouth, put hands on knees, and bend forward till your face is submerged to the eyes. Holding your breath, count ten, lift your head and exhale. Repeat until you can stay under comfortably for a count of 15. Next, practice exhaling under water; and when you inhale, turn your face to one side.

Now learn to "coast" through the water. Go out hip deep, face the shore, and stoop down with hands extended, head between the arms. Give a vigorous shove and see how far you can float. When you want to take breath drop your feet to the bottom and push down with your hands.

When you are able to "coast" 15 feet or so, breathing out under water, you are ready to learn the "crawl," the fastest and most useful of all strokes.

The Crawl. Go into the water far enough so that when you face the shore and put your palms on the bottom your head will be above the surface. In this position start slowly kicking your legs up and down from the hips, with the toes turned inward (pigeon-toed) and the knees almost straight but relaxed.

As you get the "feel" of this movement, increase the speed until you can keep up an even, rapid thrashing. Then go out farther into the water and plunge toward the shore, with arms extended, while your legs keep up the thrashing movement. Repeat this until you can keep afloat for a few yards.

The arm movement is an alternate "windmill" stroke. Practice it standing up by extending the right arm directly in front of the shoulder, then bringing the hand straight down to the hip; turn the palm outward, raise the hand upward and forward with the elbow bent until it is at shoulder height, then reach straight forward to the first position. Practice the same motion a few times with the left arm; then combine the two, with one arm going forward as the other comes back. Now go out into the water waist-deep and plunge toward the shore while keeping up the arm movement. As soon as this becomes natural and easy, add the leg movement. Start the kick as soon as the feet are off the bottom and then add the arm stroke. Make six kicks to each complete arm stroke, counting one-two-three to the down pull and four-five-six to the recovery. Most fast swimmers use the "six-beat" crawl, though some make four, eight, or ten kicks to every double arm stroke.

When you can do this in perfect rhythm for as long as you can comfortably hold your breath, turn your face to one side and inhale through the mouth during the recovery of the top arm. Keep the arm relaxed during its forward movement and hold the elbow higher than the hand so that the hand points slightly downward and enters the water first at the beginning of the pull. The back should be arched and head held high with the eyes at about the water line.

The Trudgen Crawl. This differs from the straight crawl only in leg action. A wider kick is taken at the beginning of each cycle, followed by three or five smaller kicks. In the double trudgen there are two of the wider kicks, one at the end of each arm drive.

The Side Stroke. This stroke is performed while lying on either side. The arms are pulled back alternately without leaving the water. The leg motion is a scissors kick, made by drawing the legs up slightly, keeping the knees and ankles touching, then extending the upper leg forward and the lower leg backward and bringing them together vigorously. The "single overarm" is the same stroke, except that the upper arm reaches forward above the water while the body makes a quarter roll. In the "double overarm" the body is turned completely on the breast with the face under the water, to allow the under arm to reach forward above the surface.

The Breast Stroke. For the starting position the arms are fully extended in front of the head, palms touching, fingers closed, legs straight, heels together and toes pointing slightly to the sides. The body is kept continuously on the breast. The arm stroke is made by turning the palms outward and sweeping the arms backward on a line straight with the shoulders. As the hands are brought together under the chin ready to shoot forward the legs are drawn up together, with the knees bent and open. Then they are kicked out into a V position and brought vigorously together until the heels touch.

Diving. This is an art in itself, which can only be acquired by constant practice. "Sloppy" diving is usually caused by drawing up the knees or allowing the feet to flop over as the body enters the water. Or, perhaps, out of an instinctive fear of falling head first,

the diver strikes the water flat, perhaps with painful consequences. For plain diving, the body should follow a curved path similar to the path that would be traced by a stone tossed out to the same distance. The hands should be held over the head with thumbs together and palms down, never with palms together. As the body enters the water, it should be straight, toes pointed backward. When the body is about halfway in, the hands should be bent upward at the wrist, which will tend to bring the head quickly to the surface. Keep the head down, if you want to dive deep; keep it well back for a shallow dive. Always be sure of the depth of the water before diving. Many swimmers are killed every year by diving into unexpectedly shallow water. If it is necessary to jump into the water feet first, hold the nose closed to keep water from being forced into the nasal passages.

Life Saving. All swimmers should learn how to save persons from drowning. To avoid being seized and pulled down by the frantic victim, the rescuer should approach from the rear, thrust the crook of one elbow around under the chin of the drowning person, turn him on his back, and tow him head foremost, making the swimming strokes with the legs and the free arm. Use the side stroke with the scissors kick. Keep the elbow well up with the drowning person's chin in the bend, and keep the palm of the hand on his shoulder. Tighten your hold if he struggles, and he will be unable to seize you. Experienced lifesavers have other methods, but this is the best and easiest for the beginner to learn.

SWINBURNE AS A YOUNG MAN

England's greatest lyric poet of the 19th century was a distinctive and striking figure. His large head, with its mass of flaming red hair framing a little pallid face, surmounted a small and slender body.

SWINBURNE, ALGERNON CHARLES (1837–1909). Picture a "strangely tiny" youth of 17, with a large head of flaming red hair, climbing a precipitous cliff that had never been scaled. Inch by inch he is conquering that supposedly impossible headland. Suddenly a heavy cloud of sea gulls swoops down upon him. Will he loose his hold? The gulls veer past, and we see him hanging only by his hands from a projection. Now his feet find a purchase again, and he draws himself painfully to the top, where he faints on the grass, and wakes to find a sheep nosing his face.

The hero of this adventure was young Algernon Swinburne, who was to become one of England's greatest lyric poets. The occasion was this. The boy, having finished Eton, wished to enter the British army, but his father thought he was too small and delicate for such a career. To show that he had no fear, young Swinburne then set himself the task of climbing the cliff.

Delicate as he was, Swinburne was a fearless swimmer and loved the sea. "Its salt," he said, "must have been in my blood before I was born." Once he was nearly lost while swimming three miles off the coast of France, but was picked up by a fishing boat. One of his nicknames at home, as a child, was "sea gull," and so he used to refer to the real gulls as "the others," and say that they would never harm him. He lived to write some of the most sonorous and splendid poetry about the sea that has ever been written.

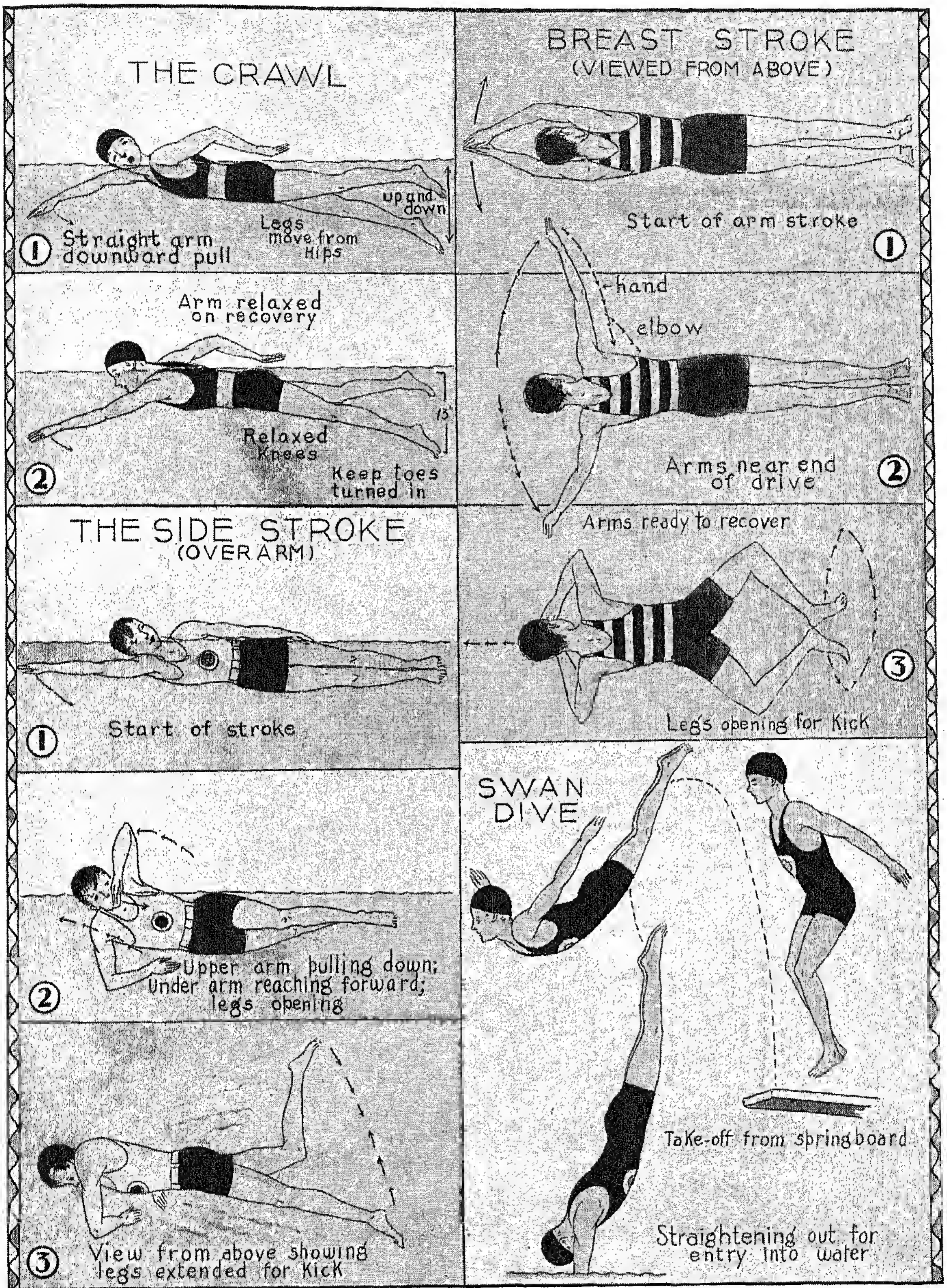
Algernon Swinburne was born in London, Apr. 5, 1837. His youth was spent on his father's estate on the Isle of Wight, and at the home of his grandfather, Sir John Swinburne, at Capheaton, in central Northumberland. The beauties of these two homes were often sung by Swinburne in his poems.

Swinburne's mother had spent her youth in Florence, Italy, and taught her son French and Italian. He read 'Orlando Furioso' by the Italian poet Tasso before he read the English poet Spenser's 'The Faerie Queen'. His early love for Italy made him later a champion of the Italian patriot, Mazzini, and of the rebirth of Italy as a republic.

His thick hair, his wide forehead, and his colorful speech made him long remembered among his schoolfellows at Eton and at Oxford. Here his reading of the classics developed his love for poetry, especially the drama of Athens and of Elizabethan England. While at Balliol College, Oxford, he came to the notice of Benjamin Jowett, one of the college's greatest teachers, and the friendship that grew between them lasted until the professor's death.

After three years at Oxford, he left in 1860 and began to write in earnest. That year he published two poetic dramas, 'Rosamond' and 'The Queen Mother'. In London he became associated with Dante Gabriel Rossetti and with Rossetti's brilliant circle of friends. For some time Swinburne shared the same house with George Meredith, Dante Gabriel Rossetti, and William Rossetti.

In the next 15 years he established himself in the first rank of poets. His 'Atalanta in Calydon' and his first volume of 'Poems and Ballads' earned him both fame and notoriety because of their pagan exuberance and rebellion against convention. Besides such beautifully lyrical works as 'A Song of Italy', 'Songs Before Sunrise', and 'Tristram of Lyonesse', he wrote brilliant though extravagant essays on Shakespeare and other Elizabethan dramatists. In 1879, when his



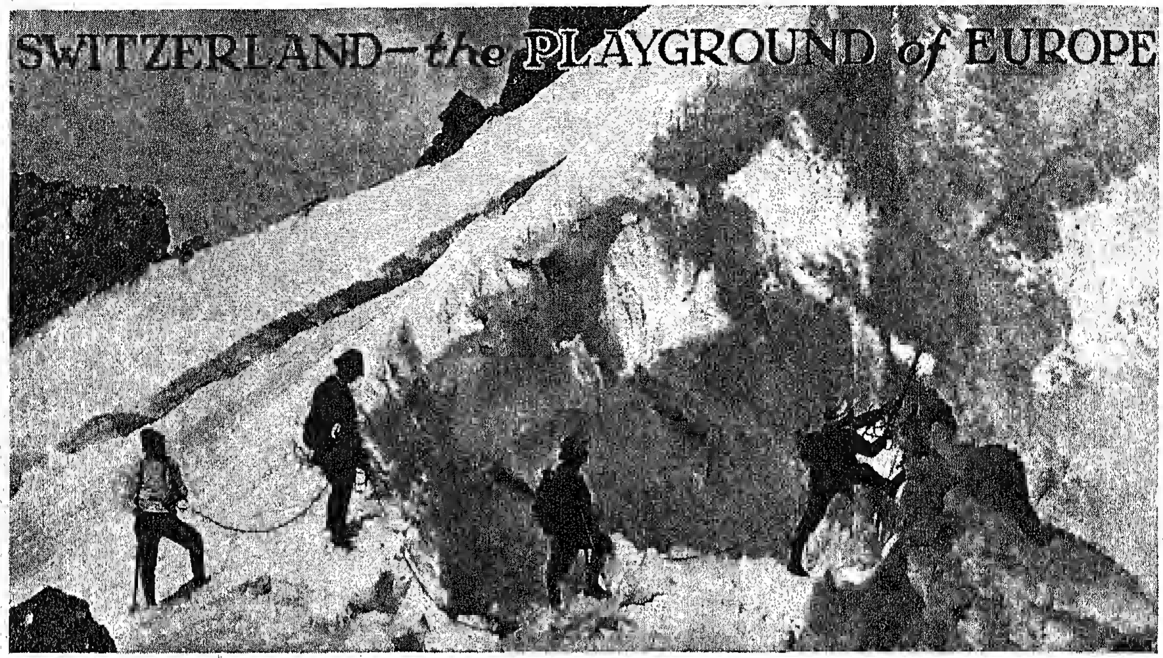
The speedy crawl stroke is the most popular of all strokes today, though all good swimmers should learn the side and the breast strokes also. These diagrams will help you master them, and the graceful swan dive, as well.

health was badly broken and his hearing almost gone, he was taken into the home of his friend Theodore Watts-Dunton in Putney. Here he lived until his death 30 years later, Apr. 10, 1909. Here, sheltered from the annoyances of everyday life, he produced some of his greatest work. The always youthful charm and sprightliness of his personality endeared him to those few whom he cared to know well.

Swinburne's contribution to English literature consists chiefly of the incomparable lyrics he created. He was a singer, not a philosopher or a teacher. His vigor of expression and his extraordinary mastery of metrical forms make his place assured as one of the most musical of English poets.

Swinburne's chief works are: 'The Queen Mother' and 'Rosamond' (1860); 'Atalanta in Calydon' (1865); 'Poems and Ballads' (first series, 1866); 'Songs Before Sunrise' (1871); 'Bothwell' (1874); 'Essays and Studies' (1875); 'Erectheus' (1876); 'Mary Stuart' (1881); 'Tristram of Lyonesse' (1882).

SWITZERLAND—*the* PLAYGROUND *of* EUROPE



MAJESTIC mountains thrusting jagged snow-crowned peaks into the sunlit sky; a thousand blue crevassed glaciers from which sparkling rivers flow to make lakes of wondrous loveliness; broad smiling valleys filled with waving fields, and busy cities in which are sold the products of matchless technical skill; a people kindly, intelligent, picturesque in costume and custom. These help to make Switzerland indeed "the playground of Europe" and "an Alpine battery against oppression."

SWITZERLAND. One of the smallest nations in the world, the mountain republic of Switzerland is yet one of the sturdiest and most secure. Its area is only 15,940 square miles, and its population about 4,075,000. It is tiny compared with the nations that press against it on all sides—Germany on the north and east, Italy on the south, and France on the west. It has no geographical unity, for Alpine ranges form massive walls between its various peoples. It has few natural resources, and so must import most of its food and practically all of its iron and coal.

But Switzerland has political unity, for its peoples are one in their love of freedom; and it has economic strength, for the Swiss are energetic, thrifty, and so skilful that their manufactures are bought by many nations. Moreover, this country has no quarrels with its powerful neighbors. They have joined since 1815 in guaranteeing it perpetual neutrality as a "buffer state" to prevent attacks, one on another, through the short cuts afforded by Swiss mountain passes. Despite this guarantee, Switzerland is well armed to defend its freedom.

In outline Switzerland is somewhat like a great armadillo or other curious monster — with the Austrian Tyrol touching its head, the Upper Rhine and Lake Constance forming the shoulders and back, the Jura Mountains and Lake Geneva defining an abbreviated tail in the west, and the main ridge of the Alps forming part of its irregular under side, which vaguely suggests creeping feet. Switzerland, however, is far from being all Alpine peaks and mountain valleys. The northwestern half, which makes up the "plateau" of Switzerland, is composed almost entirely of the rolling valleys of the rivers Aar and Thur, tributaries of the Rhine; and it is only the southeastern half that is preëminently mountainous. Only about one-fourth of the country is unproductive, including mountain peaks, glaciers, lakes, and rivers. But little of the productive area is suitable to agriculture, and Switzerland is largely dependent upon other

countries for its supplies of grain, devoting its own land mainly to pastures. Owing to the demand for wider areas of agricultural land, the country is today reduced in timber resources.

The wondrous "mountain glory" of Switzerland can best be felt in the highest Alps, which make up or are near the southwestern boundary. Here is Mont Blanc (15,782 feet) with its snow-crowned heights rising from French soil about eight miles over the border; the Matterhorn (14,780 feet), that towering pyramid of solid rock whose precipitous heights would seem to defy the boldest Alpine climber—but which nevertheless has again and again been scaled; Monte Rosa (15,217 feet), with its far-spreading mass of snow and ice, set squarely on the Italian frontier; and a score of other peaks whose awe-inspiring grandeur prints memories never to be forgotten on the mind of the beholder. Some 20 miles beyond Monte Rosa is the great Simplon tunnel, 12¼ miles long—the longest tunnel in the world—affording one of several routes by which trains pass from Italy into Switzerland across the great mountain barrier.

A STURDY BURDEN-BEARER

The women of the Saas Valley, in the French-speaking canton of Valais, are noted for their constant use of tobacco, no less than for their great strength.

For sheer joy and mountain loveliness, one must turn northward, cross the valley trough—occupied by the upper courses of the Rhone on the west and the Rhine on the east—and enter the second chain of the Alps, running parallel from southwest to northeast, to the main range. Here, in the Bernese Oberland, the chaste crystal spires of the Jungfrau (13,670 feet), and the shining peaks of the Mönch, Eiger, Aletschhorn, and Finsteraarhorn—to name but a few—stand above green valleys, at watch over sparkling glaciers or dainty toy villages. Their thick clustered snowtops almost equal in height the giants of the main range, and the glory of the panorama which they form is unequaled in Europe.

Four rivers flowing into four distant seas either rise in Switzerland or receive important tributaries from within its boundaries. The Rhine, whose source in central Switzerland lies at the foot of Mount St. Gotthard—famous for its railroad tunnel nearly ten miles long—after cutting across the eastern face of Switzerland, forms part of both the eastern and north-

THE HOME OF WINTER SPORTS

The winter sports of Switzerland are centered in the resorts of Davos, St. Moritz, and Pontresina, all in the Engadine Valley. There, 6,000 feet above the sea, with snowy peaks on every side, enthusiasts come from the four corners of the earth for skating, snow-shoeing, and tobogganing. This ice rink at Davos is said to be the largest in Europe, and is divided into various sections, some of which are reserved for games and fancy skating. Davos, which is situated in a beautiful valley at an elevation of 5,100 feet above sea-level, was for many years the home of the English critic and poet, John Addington Symonds, and was for two winters Robert Louis Stevenson's refuge from ill-health.

IN THE VALLEY OF COUNTLESS SPRINGS

The Swiss call this town Lauterbrunnen, which might be translated "nothing but springs," for on all sides are falling waters, cascades, cataracts, and rivers, as if the valley were indeed alive with springs. The waterfall at the right is called the Staubbach (Dust Brook), so named because its spray, like a fine dust, fills the air of this beauty spot. In the distance, between the two dark rock masses drawn back like curtains to disclose the chief actor on the stage, is the Jungfrau, the queen of the Alps, whose rosy tinted snows, like the blush of a youthful maiden, have inspired the name. Not so grand as the Matterhorn, the Jungfrau is one of the loveliest of all Alpine peaks.

ern boundaries before turning sharply at Basel on its journey to the North Sea. Its great tributary, the Aar, is also the chief stream of western Switzerland. On the opposite side of St. Gotthard lies the glacier whence issues the river Rhone, flowing westward down a charming valley to Lake Geneva, and thence through France to the Mediterranean—on the other side of Europe from the Rhine's mouth. From the southern slopes of St. Gotthard the Ticino River runs into Lake Maggiore, thence through Italian soil into the Po, and so into the Adriatic. Last of all, the lordly Danube receives from the Engadine valley of eastern Switzerland the waters of the River Inn, to discharge them, a thousand miles away, into the Black Sea. A circle 60 miles in diameter includes headwaters of all these four streams, so distant at their mouths.

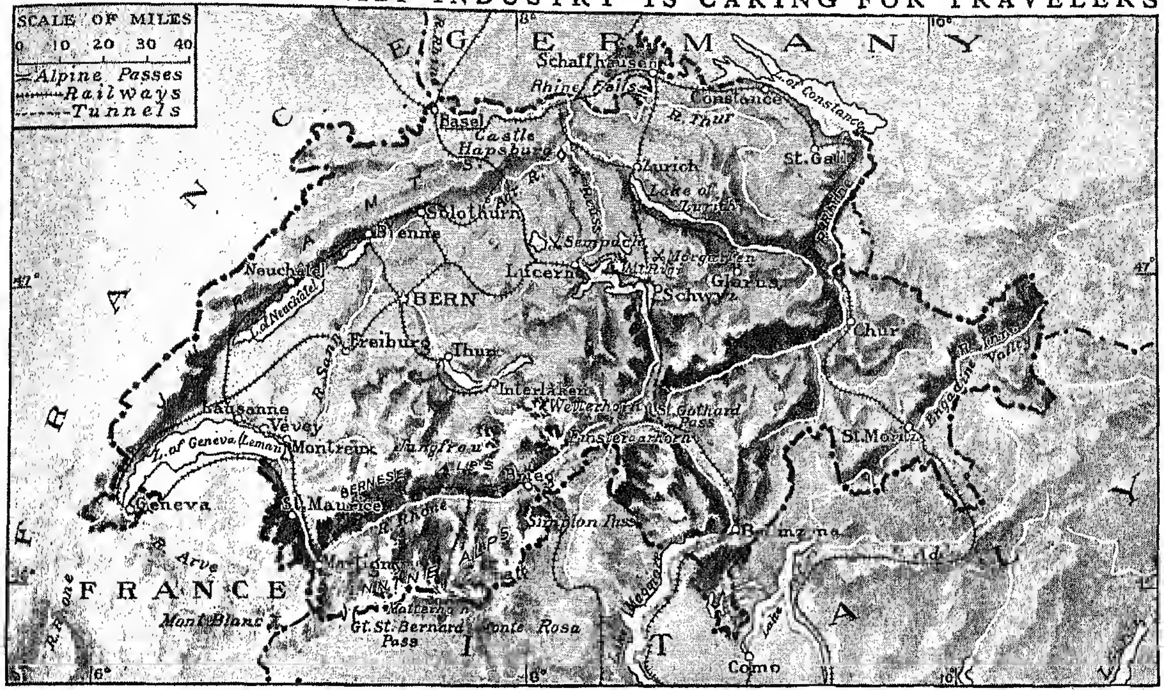
The great mountain ranges which give Switzerland its character are of comparatively recent formation, being of the same general age as the American Rockies. They lie in four zones, running roughly from southwest to northeast. The northernmost is the Jura region, of folded limestone. Then comes a sandstone plain. The third zone contains a confused mass of mountains, chiefly of limestone. The fourth and southernmost zone consists of the towering granite and gneiss masses of the Southern Alps. The mineral contents are few, asphalt, salt, iron, and anthracite being found in small amounts.

The whole surface of Switzerland glimmers with lakes of surpassing loveliness. At the northeastern and southwestern corners are lakes Constance and Geneva, already mentioned, each about 40 miles in length by 8 to 10 in breadth. Lakes Neuchâtel and Bienne, in the western plateau, are smaller; as are also the mountain rimmed lakes of the center—Zurich, Zug, Lucerne, Thun, and Brienz. Switzerland has 14 lakes, each more than four square miles in area. On the Italian border lie lakes Maggiore and beautiful Lugano, and just across the frontier in Italy—most imposing and exquisite of all—is villa-crowned Lake Como.

A History Crowded with Heroic Deeds

Under heavy odds the Swiss have won for themselves their place as one of the peoples of Europe. The three "forest cantons" of Uri, Schwyz, and

A LAND WHOSE CHIEF INDUSTRY IS CARING FOR TRAVELERS



Like many good things, Switzerland is small. Three Switzerlands could be set inside the state of New York, and all the people of Switzerland could be housed in New York City. The perpetual neutrality and independence of this little country have been guaranteed by its great neighbors, none of whom wants any of the others to rule this fair land.

Unterwalden—to the north of Mount St. Gotthard—were the first to throw off their feudal subjection to the neighboring counts of Hapsburg and bind themselves in a "Perpetual League," in 1291. Though legend has much to say of William Tell in these events, history proves him a pure myth. In the battle of Morgarten (1315) the confederated peasants—armed with lances made by tying their scythe-blades to alpenstocks—not merely withstood the armored knights of the Hapsburgs, but laid the foundations of a military system which made the Swiss pikemen for exactly 200 years the most renowned and sought-after foot-soldiers of the continent. Subsequent victories confirmed their freedom—at Sempach in 1386, where brave Arnold von Winkelried gathered the lances of the enemy into his own bosom to save his comrades; and on that winter day in 1477 when haughty Charles the Bold of Burgundy was left slaughtered, despoiled, and frozen in the marsh at Nancy. The independence of the Swiss cantons—grown to 13 by that time—was formally confirmed in the treaty of Westphalia in 1648; and in 1815 the Congress of Vienna guaranteed their perpetual neutrality. At the same time the number of the cantons was increased to 22 by the formal accession of Geneva, Neuchâtel, and other districts.

Not merely does Switzerland lack geographical unity—it lacks as well unity of race, of language, and of religion. In most of the cantons, including all the earlier confederates, German is the language of the people. But in five western cantons French is the common language, and in one canton in the south (Ticino) the people speak Italian. In one canton (the Grisons) the old dialect called "Romansch"—derived from the ancient Latin of the people—is still in everyday use. The flourishing cities of Zurich (under Zwingli) and Geneva (under Calvin) were influential centers of the Protestant Reformation, but more than 40 per cent of the people are Catholics.

The rural Swiss are marvels of thrift, forcing out a livelihood from the slimmest strip of valley soil, and living for generation after generation in the same trim picturesque ginger-colored houses, or "chalets." Grapes for wine are raised on the sunny slopes of the Jura and the Alps, and considerable quantities of fruit are grown. Grazing and dairying, however, form the chief support of the people. In summer they make a village holiday of moving their cattle from the lower to the higher pastures for the sake of the sweeter, fresher grass; and in winter the famous Swiss cheeses ripen in the cellars during the great Alpine storms. The rivers and streams, which are carefully controlled to prevent floods, at the same time irrigate the Swiss meadows, which in spring are bright with flowers. The women make beautiful embroideries to swell the family savings, and the men toil up and down the mountain heights as hardy guides for parties of mountain climbers.

No such placid dreamy spirit lies over Swiss cities. Of these about 25 have more than 10,000 people—Zurich, Basel, Geneva, Bern (the capital), St. Gall,

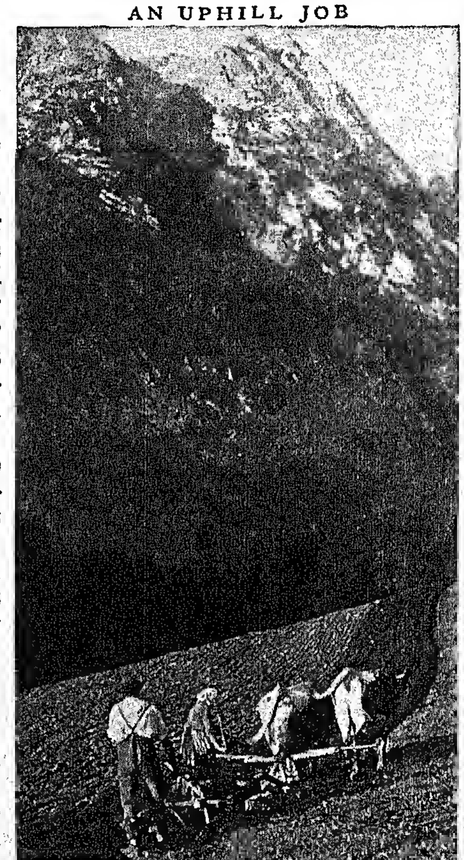
and Lausanne being the largest. Their clean streets and well-kept walks and parks stream with foreigners, and the tourists, their guides, and their mountain climbing paraphernalia are everywhere. Switzerland's miles upon miles of splendid roads, leading over the mountain passes into every picturesque valley, make the land a paradise for motoring; and the efficient government-owned railways, and the rack-and-pinion lines which now ascend most of the important mountains make sightseeing easy for the non-athletic and poor in purse.

Brisk Sports of Winter Time

Of late, skiing, tobogganing, and other winter sports have attracted nearly as large crowds as the more smiling summer season. History with its deep charm, for the imaginative traveler, clings also about many Swiss cities—such as Geneva, where walk the ghosts of stern John Calvin, brilliant Mme. de Staël, the revolutionist Jean-Jacques Rousseau, and skeptical Voltaire. Americans take thought of the past in the canton of Zurich, whence in 1710 came large numbers of religious refugees to settle in Pennsylvania and swell the numbers of the so-called "Pennsylvania Dutch." Not only past but present-day historical figures play out their drama here. Switzerland has long been a refuge for political and other refugees from other lands, and since the World War many deposed kings, outcast nobles, and unsuccessful revolutionists of every hue have found asylum there.

Caring for tourists is the leading industry, but Switzerland bustles with manufactures of every sort. At Geneva, Bern, Neuchâtel, Chaux-de-Fonds, and Locle are made the famous Swiss watches and clocks, with jewelry and tinkling music boxes as an added line for some of them. Zurich, Basel, St. Gall, Glarus, and Appenzell hum with the textile industry. Emmenthal and Gruyère make Swiss cheese, and Swiss chocolate and condensed milk come chiefly from Vevey. In many Swiss mountain hamlets whimsical and elaborate wood-carving attracts tourist dollars. Excellent technical schools, turning out finished craftsmen, and intelligent development of water-power to furnish electricity, are the two strong arms of Swiss industry. Higher education is cared for by seven universities, of which the one at Basel (founded in 1460) is the oldest. Lack of coal is a serious handicap, but some use is made of lignite and peat.

AN UPHILL JOB



It is an uphill job literally as well as figuratively for it has taken years to clear this field of all its rocks and small stones. Switzerland probably has a larger percentage of mountain area than any other country in Europe, but it also has fertile valleys in the very shadows of mountains capped with eternal snows, and in its northern part it is a fairly level plain.

Bern, the capital of the federal government, has little industrial importance, but is famous as the seat of various international conferences and associations. Since the adoption of the present constitution in 1848, Switzerland has had a government somewhat like that of the United States, with a supreme court, a house of representatives, senate, president, and federal council with duties corresponding largely to those of the president's Cabinet in the United States. The president, however, is elected annually by the two houses of the legislature, and his powers make him little more than chairman of the federal council. Each canton has its own legislature, executive and judiciary. Three of the older and less densely populated cantons have preserved their ancient democratic assemblies—similar to the New England town meetings—in which each citizen of the canton appears in person; usually they meet once a year, on the last Sunday in April or the first Sunday in May, and always (weather permitting) in the open air. These assemblies elect a sort of standing committee and also the chief magistrate of the canton as well as the judiciary.

The excellent federal management of Swiss railroads, postal system, and public education is everywhere famous, as is also the system of national defense. This rests upon the national militia. At 18 years of age, all men are required to serve for an extended period in the militia, unless excused for a special reason, such as health. Then for several years they spend a brief time annually in military training courses. Men who do not serve under arms are organized to carry on noncombatant duties during wartime. Gun clubs making the Swiss excellent marksmen, are found in every town and village, and the whole matter of army service is looked upon as a joy rather than as a burden. Among other institutions of the Swiss, mention must be made of the "initiative and referendum," which other countries (including some states of the United States) have borrowed as a valuable and democratic legislative device (*see* Initiative, Referendum, and Recall).

The Glaciers of Switzerland

LET us go to Switzerland for half an hour for a winter holiday; let us go for a short ride to the massive world above the clouds up the great stairway that leads us a mile nearer to the sun. We will imagine that we are in one of its popular centers—the Engadine valley in the southeast, which lies about the famous health resort of St. Moritz in the canton of Grisons.

Up into the Rhaetian Alps we go, our little engine panting with its trainful of happy people, up the steel way that lifts us nearer and nearer to the sun. Thrilling and beautiful it is to look through the broad windows across the ravines to the fir-clad mountain slopes, up the great heights ever white with snow, through the graceful arches of the long stone bridges rising from the valley bed, down the deep gorges with their rushing torrents a hundred feet below us.

We are riding up to the eternal snows, but here, all about us, millions of fir trees grow, and their green branches, hanging heavy with snow, with the long white daggers at the tips, are a glorious sight to see.

It is almost too good to be true, this beautiful world. Yet this is no dream, for there, right below us, is a little town; and there, right above us, is another. Over these bridges, and through these tunnels, and round these curves, and up these spiral ways we go, and we think that surely men have never made a more daring way than this.

Climbing the Alps in a Railway Train

The ships in the Panama Canal go upstairs and down again on their way from one ocean to the other, but even this is a simpler thing than lifting a train up the mountains of the Albula Pass. We go around and around, through more than 40 tunnels, over a mile and a half of bridges, and nothing could be more ingenious than the way in which the clever makers of this line carry it ever up, safe all the way. It is as if a train were to rush into a church and come out at the top of the steeple, and this miracle is seen every day in the Alps, until the wonder of it all is lost.

Out at the top, at Bergün, we ride along the side of a precipice nearly 500 feet above the valley bed; and we cross a deep ravine, bridged by 11 great arches, with such a sense of safety that nobody fears the train will fall into the river 275 feet below.

Beyond Preda we reach the Albula Tunnel itself, three and three-quarters miles long, and in the tunnel we climb to our greatest height. Out from the heart of the rock we rush into the sun, a mile above the world of men. One mile of space we have conquered between us and the sun, and a wonderful vision it is that we get of the earth.

It is not true that a railway destroys the poetry of the Alps. There is true poetry in this way of a thousand wonders, the way which, when all other roads are closed, is still open to bring the traveler to these wonderful tops of the world. It is as thrilling to think that men have made this railway, that men have searched deep down in Nature and found the natural laws that will lift a train to these great heights, as it is to climb up a mountain with a stick and a rope, risking a life which is not ours to throw away.

For three hours we have been riding, and at last we reach Bevers, and in front of us are the great white peaks. As we step into the snow we wave goodbye to our brave little train, and we think of it as a poet thought of something like it:

> It lifts me to the golden doors,
> The flashes come and go;
> All heaven bursts her starry floors
> And strews her light below.

Now our minds, filled with the wonder of these few hours, are at ease again, for outside the station the sleigh bells are ringing, our bags are set on a sort of great toboggan, and we glide along the snow, up the hills by the bob-sled runs, down again past the little churches, to a hamlet where we may live among glaciers and chamois, with an electric railway which will carry us up to them.

The Stories of the Mountains

It is good for us to live among the mountains. Something we shall not quickly lose comes into our life as we look upon a glacier, the great white river coming slowly from the mountain-tops. We must see them in the summertime to see them at their best, when the river of ice comes down through a forest ablaze with summer glory, through vineyards and cornfields and orchards, so that those who would gather the fruit must stand sometimes on a block of ice to reach it. Winter and summer are here side by side; life and death together, we see them.

But perhaps we should not call this river Death, for travelers say that in the hot sun you can almost hear it singing. This solid river of fantastic shapes, with deep crevasses and rising towers, with a surface twisted and tortured and broken, with a burden not of ships and boats but of rocks and pebbles and bowlders, goes on its resistless way, not falling softly over a precipice like water, but splintering and shivering in cracks, and coming together again in some mysterious way as if it had never been broken. These crackings in the mass, the rolling down of great bowlders, the melting of ice, the falling of pebbles into some deep crevasse, have sounds like thunder and soft music, and those who know these glaciers will tell you that they love the singing of the ice. As the trees sing in the forest, so the field of ice that runs past is filled, says one traveler, with the harmony of joyous sounds. "The little drops, falling on the projections in the crevasses, tinkle as they are broken up; the gradually forming rivulet murmurs on its way; the slopes of gravel crumble down into the crevasses; and here and there some block, uncemented from its icy pedestal, roars as it rolls down. All these voices

of the glacier gain strength as the sun gets higher in the horizon, but if a thick cloud suddenly interrupts the solar rays silence is gradually reëstablished, and the glacier waits for the return of the sun ere it resumes its song."

But in winter, too, a glacier does its work; in winter, too, with snow and ice about it everywhere, it is a majestic thing to look upon. The snow will melt where it lies, but the glacier never will melt there; it will go down into the valley and fill narrow beds with babbling brooks; it will dash over a cliff as a waterfall, or fill up a valley and form a lake, or join the Rhine and go out into the cities of Europe and on into the North Sea, and across the Atlantic Ocean —perhaps it will be carried by a current some day to the Panama Canal.

None of us will be there to see, but it will go. The flake of snow will melt. The drop of water will find a crevice in the ice, and there it will freeze again, and explode with a power like the power in a bomb filled with powder; and this melting and freezing in the glacier, happening always, everywhere, will move it from the hilltop to the plain. It may take a hundred years to reach the valley, traveling perhaps two feet a day, but time is nothing to a glacier, and in the Alps a hundred years is as an hour. *They* have the ages before them; *we* must work while it is day.

The glacier rolls along as surely as the Mississippi. This river of ice, solid to the bottom a hundred yards deep, rolls to the sea as surely as the wind sweeps over a field of wheat. The solid waves on its surface rise and fall, eddy and whirl, ripple and splash.

The Resistless Movement of the Glacier

We stand on a glacier and are borne along as certainly as in a boat on a river of water, and we understand that there are things beyond our senses, movement that we cannot see. There is no doubt of it whatever. In 60 years one glacier toppled over dozens of chalets. In 1827 a professor built a hut on a glacier to study the ice. In three years it moved 330 feet, in 9 years 2,000 feet, and in 14 years it was nearly a mile away. It once took a glacier 12 years to carry a man's hat a mile. Another took a bottle half a mile in 9 years, and 70 yards in 3 years. In 1820 three guides perished below the heights of Mont Blanc, and after 41 years the bodies arrived at the foot of the glacier 5 miles away; from a depth of 200 feet down they had reached the top, so that 200 feet of ice had melted. Now and then a shoe or a stick or a bone comes up in a glacier, the remains of some unhappy traveler long forgotten; and once, in 1860, a glacier threw up the body of a man in a costume centuries old—gave his body back to the world quite well preserved, like a mountaineer walking out of an old-fashioned costume-book!

So surely do they move, pushing before them or carrying with them rocks shattered from the mountainsides or torn up from their own rocky beds. Like a saw or a plane the glacier makes its way along its bed, not gliding over the earth, but gripping it fast, so that we can see the marks where it has passed, and a stone falling through a crevice to the bottom is dragged along, leaving a great scratch in the earth. Who knows what this giant brings with him as he comes? He brings the spoils of distant mountain slopes, the ruins of famous mountain peaks, pebbles worn as smooth as glass, bowlders weighing a thousand tons. No wonder we find a peasant sometimes afraid of him, for though he comes slowly, the giant glacier comes dreadfully at times, so big that six Chicagos or New Yorks could be made out of him. If he should come to the end of a valley and cross the bottom so as to close it up, his coming might spell doom to that valley. There is a valley in the Alps once crossed by a glacier which formed an ice barrier half a mile long, and the valley was drowned in 800 million cubic feet of water. Then the people rallied around an engineer and dug a tunnel in the ice, through which the water burst in a volume a hundred yards high, sweeping away a plantation, spreading devastation and ruin on every hand.

The Wonder of the World of Peaks

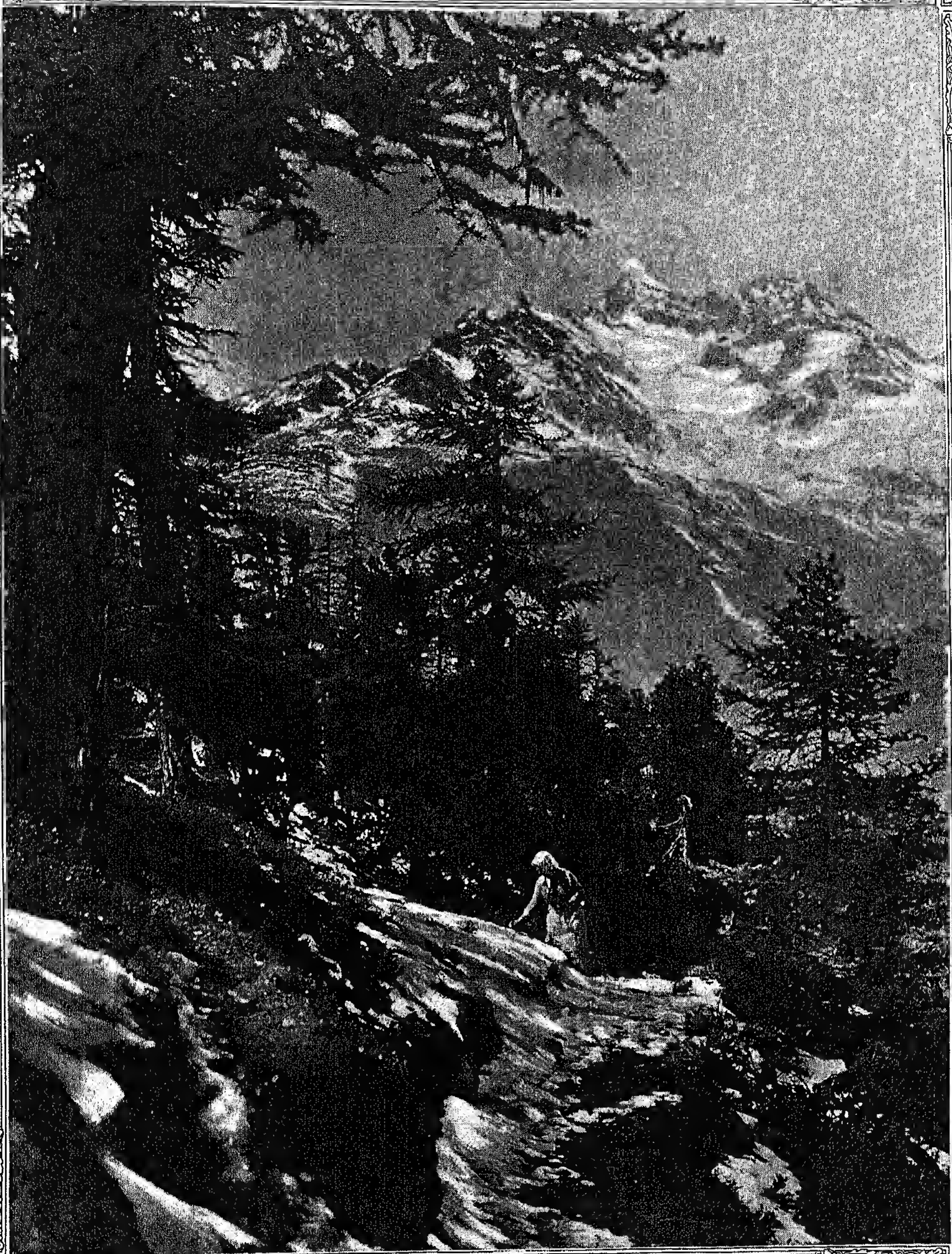
It is a wonderful thing for those who live in lowland towns to take one of the little Alpine trains and be lifted into a world of snow-white peaks and icy precipices, seeming to stretch from your window away into ever and ever. No words can tell it, no brush can paint it, no camera can copy it; he who would understand its fascination must see it.

And if, when you go, you leave the train at Alp Grüm, you will stand then a mile and a half nearer the sun than when you left France. It is called the Palü Glacier on the map, but how little a name really means! From the peaks high above us this incredible river of solid ice gathers the force that drives it down the gorge through which it slowly cuts its way. Over there, down, down, is the road that leads to Italy, and we look down to see what the road is like. But we see nothing, for below us are *the clouds!* Like a lake of water they hang in the air, and we wonder what it is like in the village where the people walk below them. From the clouds below us we look to the skies above. High up above the glacier is the blazing sun; lower down, above the falling clouds, hangs the pale white moon.

Wonderful it is to be standing in this place, to stand and see, in one place and in one moment, these pillars of the heavens and of the earth, four links in the long, long chain that binds the universe, four chapters in the story of the world!

We are looking on at the ever-new creation of the world. Above us are two huge moving things—the sun and the moon. Below us are two huge moving things—a sea of cloud and a mighty glacier. What unity can there be between the soft quick-moving sea of cloud, like down, filling the valley below us, and the solid slow-moving river of ice, like masonry creeping down the mountain slopes? Well, in the wheels of God, that run forever, they fit like four wheels of a watch. It was the sun that brought them

SPRING'S FIRST FLOWER IN WINTER'S SNOW

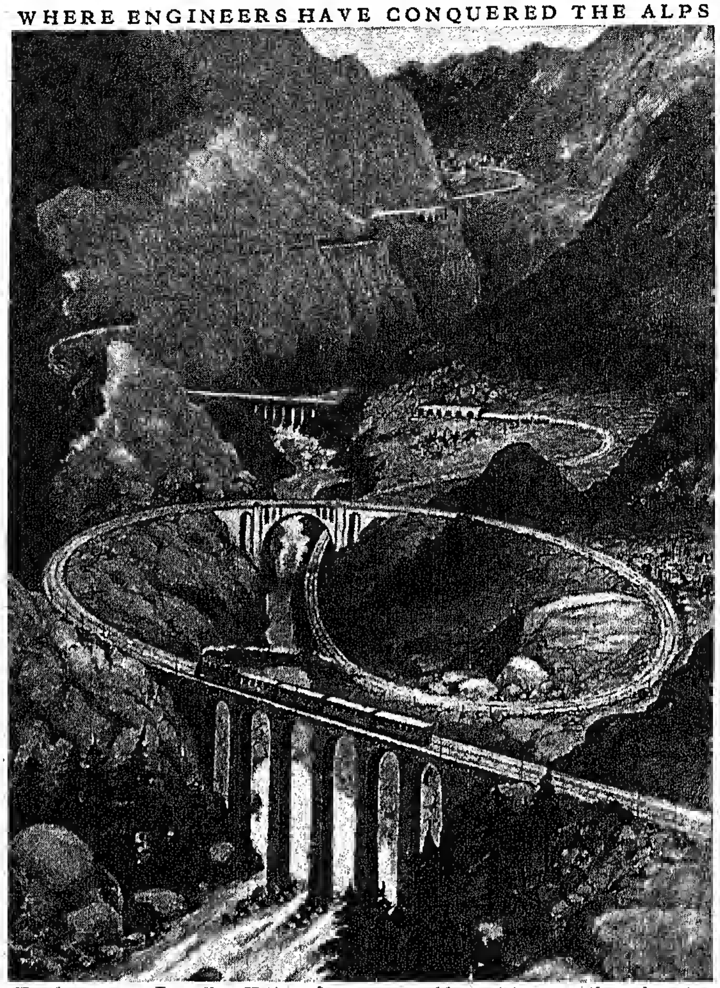


Wherever you may go in Switzerland, you are not far away from majestic scenes like this, with towering mountains clothed in perpetual snow looming up from the dark green of the evergreen forests. This view is typical of the high Alps—a mighty massif with several soaring peaks. In long zigzags, to keep them from being too steep, paths like this lead up through the forests of the lower mountain slopes. Cattle are driven by these paths to summer pasture in the high Alpine meadows. If there were an opening in the trees we could look down the mountainside and see the valley far below. This Swiss woman is searching for edelweiss—the small white woolly-leaved flower native to the high Alps and beloved of the Swiss people. Once plentiful, edelweiss ("noble white") is now usually found only in the most inaccessible places. Because of this, and because its home is in the peace of remote mountain solitudes close to the virgin snows, the flower has come to be an emblem of purity.

here. That blazing ball in the sky sucks up tho cloud from the sea, and drops it as snow, which freezes to ice and forms the great white glacier cutting its way through the rock. From the sea came the clouds, the glacier, the very Alps themselves. And the moon hanging there—what place is hers in this great scheme of things? She is waiting her time. She will shine on this great white river tonight, catching a glow of the sun and giving it back to the earth, and perhaps for a million nights to come she will shine on a glacier here, silently watching the great thing move, though seeming powerless to move it herself. Yet she waits her time, and when her time comes she will pick up this great white glacier and dash it against the cliffs, splashing it about in the sea as a child splashes a wave with its foot.

So that this very sun may draw this very cloud up to the skies, this very cloud may fall as snow and creep as a glacier down this very gorge; and this very moon, when the glacier has become a river and reached the sea again, may roll it along in the tide to the very beach on whieh you play. We stand in this place and watch it all. The wheels of the universe are going around before our eyes, yet how still it is! Slowly, silently, surely, the mills of God go round, and they grind exceedingly small.

WHERE ENGINEERS HAVE CONQUERED THE ALPS



Up the narrow Engadine Valley, first on one side and then on the other, in one mountain side and out through another, turning to every point on the compass, runs the Albula Railroad, the most wonderful narrow-gauge road in the world. This photograph shows the stone viaduct over the Landwasser, a tributary of the Upper Rhine. Emerging at the right from a tunnel, the train dashes across the curving bridge, 213 feet above the torrent. In the mountain at the left are two loop tunnels, whose position has been indicated so that you can get a better idea of some of the complicated problems faced by the construction engineers.

Meditation in the Silences

The silence of an Alpine height can never be destroyed. Here comes no thunder from the world below; the mountain peak is like a throne of meditation for the human raco. And well it is that men should meditate in these great silences. How came they here—these giants that have raised their heads to the sky since the first man was born? The answer to that is a tale no story-book ean rival. These mountains, holding their heads proudly to the sun, once stood at the bottom of the sea. These dazzling peaks, keeping company up there with the eagles, once bowed down their heads among sharks and whales. And the day will come when these virgin towers of heaven, tired of the eagle and the sun, will go down into the sea again, and rest from age to age in the dark cold waters.

Even now they are on their way. The Alps are tumbling down; the rivers trickling down their sides carry them away. As surely as the bricks are being removed from some old building that has fallen down, so surely the bricks of the Alps, the heights and depths of this great mountain range that shelters Italy from the outer world and gives a home to the brave Swiss people, are being removed by visible forces, carried on the backs of raindrops.

We look down on the great Walls of Silence that keep back the noise of Europe, where not an echo of war comes, nor the whirring of the wheels of peace. Yet what men call the Evolution of the World is at its height about us. These Alps, that look so still, move every hour—move not merely with the movement of the earth in space, but move of themselves where they stand, crumbling into dust, marching to the sea.

Three great processions to the sea we witness from any Alpine height. The snow is melting, and the water is trickling down wherever it can find a bed; it is going to the sea. The solid white river of ice is

moving as fast as it can go; it is moving to the sea. The great granite peaks are wearing away, and their dust is carried down to the sea. From the sea they came, to the sea they go, and forever the procession moves on.

We come down to the happy life of the valley again, with its healthy play, the skiing down the mountain-sides, the tobogganing down the runs, the sleighing over the snow, the skating and curling on the ice.

From these scenes we can turn to watch, if we will, the simple life of the Alpine hamlet. The women bring their washing to the fountain in the street. The cows, driven from their pastures by the snow and spending the winter in dark sheds under the houses, take their peep of daylight in the afternoons. Pleasant sleigh-bells jingle in the streets. The tiny shops are full of quaint and pretty things, especially the shops of the peasants, who will cut a piece of fine close-grained timber and carve it at their doorway into a wonderfully vivid eagle or a chamois.

Higher up on the mountain slopes we may see a chamois come slowly down to a pool to drink. His lofty retreat high up in the peaks may be the grave-yard of creatures that lived and died in the sea; for even at two miles high sea fossils have been found. These heights were forced up from the ocean ages ago by enormous pressure of the rocks, much as the parts of a paper ball are forced up if we press it at the sides.

—REFERENCE-OUTLINE *for Organized Study of* SWITZERLAND—

SWITZERLAND, which came into existence more than 500 years ago, was the first country of Europe to achieve popular liberty and a democratic form of government. Its power and wealth were the result of its situation along the highways of commerce between Italy, Germany, and France. Throughout all the struggles that have swept Europe in the last five centuries, Switzerland has been able to maintain its independence, chiefly because of: (1) the bold, liberty-loving character and military skill of its people; (2) the protection afforded by the strong rivalry between neighboring states, none of which was willing to permit another to occupy this strategic position in the Alps; (3) the lack of great natural resources to tempt the more powerful nations to such determined efforts as would be necessary to seize and hold this vast natural fortress. Switzerland today is a land devoted to grazing and dairying, agriculture, manufacturing, and commerce—all on a small scale. Among the principal sources of prosperity are the scenery and the climate which annually attract thousands of tourists who leave behind them great sums of money.

I. PHYSIOGRAPHY: S-348–50, S-353–7.

A. Mountains: Alps S-353-7, A-135, E-317 picture; Jura Mountains J-229; Famous Peaks S-349.

B. Narrow Plateau Between the Two Ranges: S-348.

C. Rivers Rising in Switzerland: S-348, S-350. Rhine R-93; Rhône R-100; Flood Control and Irrigation S-351.

D. Other Physical Features: Many Lakes S-350; Majestic Glaciers S-353-7.

II. NATURAL RESOURCES: Scenery S-349, S-353-7; Pasture Land S-351; Water Power S-352.

III. CHIEF INDUSTRIES:

A. Tourist Business: S-351–2. Winter Sports W-116, W-118, S-348 picture, S-349 picture, S-352.

B. Dairying and Agriculture (Chief Products—Cheese, Condensed Milk, Chocolate, Fruit): S-348-9, S-351, S-352 picture.

C. Manufacturing (Chief Products—Watches and Clocks, Wood-Carving, Toys, Embroidery): S-352, Z-232, T-118, S-145, S-146, B-101.

IV. TRANSPORTATION: S-349, S-352, S-353, S-356.

V. CHIEF CITIES: S-351–2. Zurich Z-232; Basel (Fact-Index); Geneva G-29; Bern (capital) B-100.

VI. PEOPLE OF SWITZERLAND—NO UNITY OF RACE, LANGUAGE, OR RELIGION: S-351, S-349 picture.

VII. SALIENT FACTS IN THE HISTORY OF SWITZERLAND: S-350–1.

A. Lake Dwellers: M-48.

B. Formation of the "Perpetual League" in 1291: S-351. William Tell Legend T-43.

C. Defeat of Hapsburgs at Morgarten and Sempach: S-351. Arnold Winkelried W-114.

D. Repulse of Charles the Bold at Granson, Morat, and Nancy: C-153.

E. Swiss Leaders in the Reformation: R-65. Calvin C-35, S-352; Zwingli Z-232.

F. Treaty of Westphalia in 1648, Formally Confirming Swiss Independence: T-81.

G. Initiative and Referendum, Originating in Switzerland: S-352, I-78-9.

H. Napoleonic Wars:

- **a. Geneva Annexed by France in 1798 and Freed in 1815.**
- **b. Congress of Vienna, Perpetual Neutrality Granted to Swiss Cantons: S-351, V-298.**

I. Adoption of a New Constitution in 1848: S-352. Federal Management of Railroads S-352.

- **a. System of Government: S-352.**
- **b. No Standing Army, Military Training of Youth: S-352.**

J. Bern Made the Capital of Switzerland: B-101.

VIII. EDUCATION: S-352.

IX. SWITZERLAND AS A CENTER OF INTERNATIONAL HUMANITARIAN AND PEACE MOVEMENTS: S-352.

A. Founding of International Red Cross at Geneva in 1864: R-59-60.

B. Arbitration of the 'Alabama' Claims in 1871: A-99.

C. Swiss Neutrality in the World War of 1914–1918: W-149.

D. The Lausanne Treaty of 1923: G-162, T-164.

E. League of Nations Established at Geneva in 1920: L-78.

F. Bank for International Settlements Established at Basel in 1929: I-110.

Bibliography for Switzerland

—Books for Younger Readers:

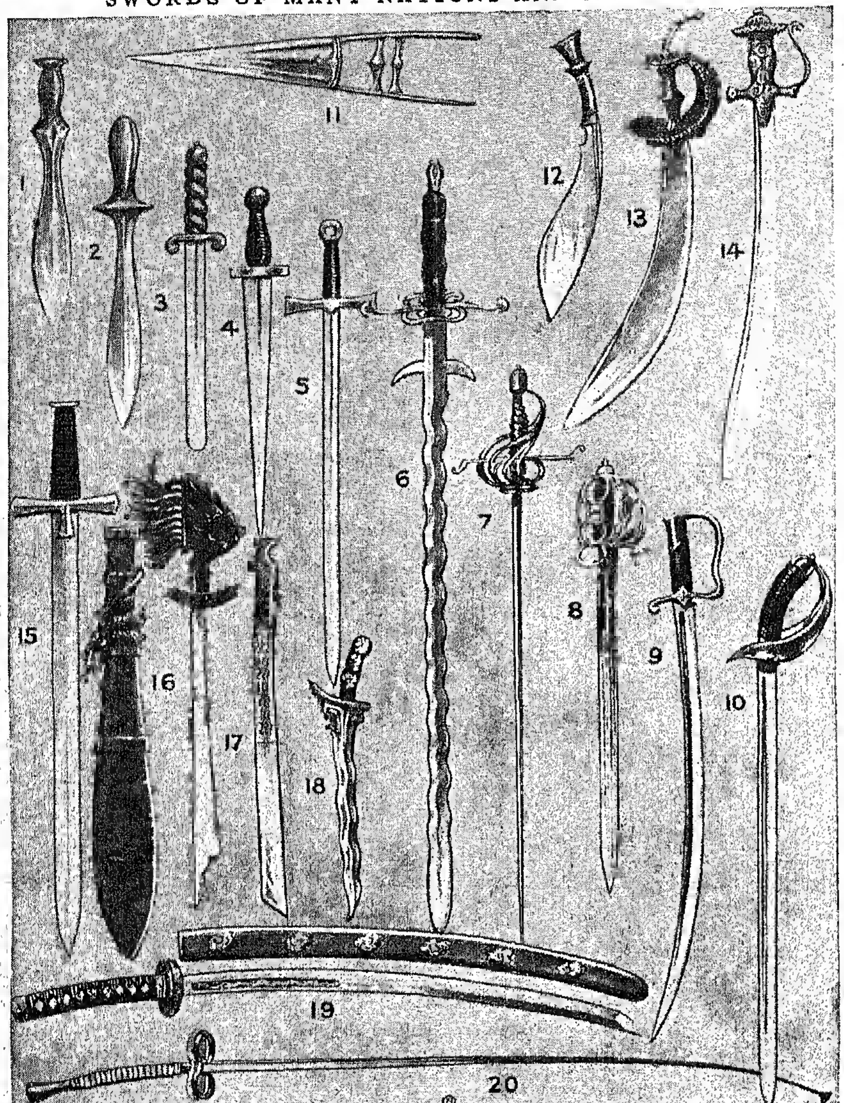
Bragdon, L. J. Land of William Tell (Stokes, 1938).
Buff, M. M. and Conrad. Kobi, a Boy of Switzerland (Viking, 1939).
Carpenter, Frances. Our Little Friends of Switzerland (Amer. Book Co., 1941).
Carpenter, Frances. Tales of a Swiss Grandmother (Doubleday, 1940).
Davis, Julia. Mountains are Free (Dutton, 1930).
Duvoisin, R. A. Three Sneezes and Other Swiss Tales (Knopf, 1941).
Olcott, Virginia. Anton and Trini (Silver, 1930).
Seidlin, Oskar and Rypins, Senta. Green Wagons (Houghton, 1943).
Spyri, Johanna. Heidi (Houghton).

—Books for Advanced Students and Teachers:

DeBeer, G. R. Alps and Men (Longmans, 1932).
Keller, Gottfried. People of Seldwyla and Seven Legends (Dutton, 1929).
Lunn, A. H. M. Exploration of the Alps (Holt, 1914).
Oechsli, Wilhelm. History of Switzerland (Macmillan, 1922).
Rappard, W. E. Government of Switzerland (Van Nostrand, 1937).
Rougemont, Denis de and Muret, Charlotte. Heart of Europe (Duell, 1941).

SWORD. That "most romantic of weapons," the sword, has been the symbol of war, the badge of honor and courage among fighting men, since the days when bronze and iron were first hammered into blades. The right to carry a sword has almost always been a mark of rank; and today, when most of its usefulness has departed, it remains part of the dress uniform of army and navy officers the world over.

SWORDS OF MANY NATIONS AND MANY AGES



Numbers 1 to 10 show the development of the sword from the most ancient known examples to the World War; numbers 11 to 20 are modern weapons of various nations. 1. Sword of the Bronze Age. 2. Greek. 3. Roman. 4. Norman (about 1066). 5. Crusader's. 6. Two-handed, 15th century. 7. Rapier, 16th century. 8. Basket-hilted Ferrara, 17th century. 9. French cavalry, about 1800. 10. English cavalry, 1914. 11. Dagger from Mahratta. 12. Gurka "kukri." 13. Indian "talwar." 14. Indo-Persian scimitar. 15. Soudanese sword and scabbard. 16. Sword from Timor (in the Malay Archipelago). 17. Central American "machete." 18. Malay "kris." 19. Japanese sword and scabbard. 20. Fencing foil.

In the days of chivalry knighthood was conferred by the flat of the sword laid on the young warrior's shoulder; in many lands kissing the ruler's sword was a token of homage; oaths taken by a soldier on his sword were rigidly binding; when a general surrendered his sword, he admitted complete defeat; and to have his sword broken by his superior officer was the worst degradation that could come to the disloyal or cowardly soldier. These and many other sword ceremonies reappear constantly in history, while all mythologies and folklore contain tales of magic swords, like King Arthur's "Excalibur."

In modern warfare, the work of the sword, and of its smaller brother, the dagger, and of its cousin, the spear or lance, is mostly done by the bayonet fastened to the rifle muzzle, or carried in a scabbard at the belt. But for many centuries before the invention of firearms, the sword in one or another of its many forms was the principal weapon of the fighting man.

The sword's ancestor was probably the stone dagger of the cave man. Among the earliest historical blades are the leaf-shaped arm of the Greeks and the long thin Assyrian sword. As nations progressed in the military arts, they usually shifted from the chopping swords to the sharp-pointed thrusting weapons. Thus the short sword of the Roman legionary defeated the heavy blunt-ended sword of the northern barbarians, and it was literally "at the point of the sword" that the Mohammedans, who carried curving scimitars and yataghans which could only be used for slashing, were kept out of Europe.

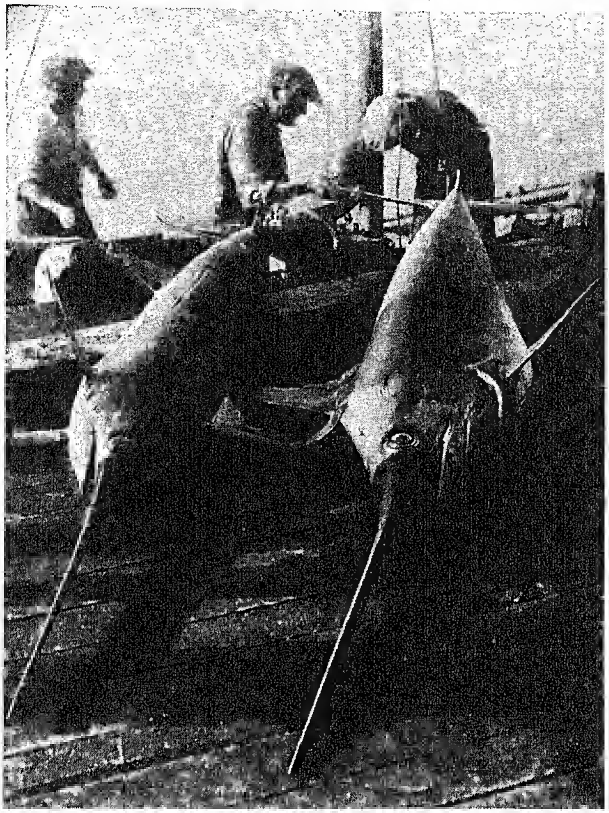
The heavy two-handed sword of the Middle Ages was abandoned as soon as the invention of firearms destroyed the usefulness of shields and armor. In its place grew up the saber, the rapier, and the smallsword, and with these lighter blades swordsmanship became a fine art. During the 17th and 18th centuries in Europe, it became the custom for all men, even civilians, to carry swords, and quarrels were usually settled on the spot with cold steel. In the reign of Louis XIII in France

dueling became such a rage that fencing masters were everywhere in great demand and highly honored. Earlier duels were fought with sword in one hand and dagger in the other for parrying. Later a cloak took the place of the dagger, and finally with the adoption of the slender, needle-pointed rapier even this protection was abandoned.

The saber, either straight or curved, was always the special weapon of the cavalryman, and it survives today in some armies. The short cutlass was the arm of the sailor.

Various races and peoples have had special swords and daggers associated with their names throughout history. Thus we hear of the curved tulwar of the Persians, the sickle-shaped kukri of the Indian Gurkhas, the Malay kris with its wriggling blade, the delicate katana of the Japanese, the heavy-pointed machete of tropical America, the deadly bolo of the Filipinos, the bowie knife of early frontier days, and scores of other members of the sword family. Sword making used to be one of the most honorable trades. The cities of Damascus, and of Toledo in Spain, formerly owed much of their reputation to the skill of their swordsmiths.

VANQUISHED GLADIATORS OF THE SEA



The sharp stout beak of the Swordfish, which may be as long as three feet, can pierce the planking of any ordinary small craft. This makes the sport of catching Swordfish, whether by rod and reel or by harpoon, thrilling and hazardous.

Swordfish and Sailfish. A champion duelist and bullying swashbuckler of the open seas is the huge swift swordfish, whose rapier-like snout is always ready as a weapon of attack or defense. Like an insolent soldier of fortune this bold fish roams the seas far and wide. He infests the Mediterranean, and travels widely in both the Pacific and Atlantic.

The swordfish is shaped like a mackerel. He grows from 4 to 15 feet long, weighs from 150 to 800 pounds, and fears nothing that swims or floats. His "sword," sometimes three feet long, is formed by the prolonged and toughened bone of the upper jaw, which is somewhat flattened and has an exceedingly sharp point.

Swordfish swoop upon a school of menhaden, herring, or mackerel, stabbing and cutting up in a few minutes an incredible number of these fish, which they then proceed to eat. But they gladly turn from their prey to attack a whale or a giant squid, toward which they seem to feel an unreasoning ferocity. In these combats they are usually victorious.

Swordfish frequently assail boats and ships, probably mistaking them for whales. They easily pierce the light canoes of the Pacific island natives, and even the heavier ships of the professional swordfish-hunters, often wounding persons in the boats. Attacks by these monsters even on larger ocean-going vessels have been so common in the past as to be recognized in law as among the "perils of the sea." An English jurist once described in court the power of their attack as "equal to the accumulated force of 15 double-handed hammers!" They shoot themselves through the water with such speed that they have been known to drive their sharp weapons clear through the copper sheathing, oak planks, and timbers of a ship to a depth of ten inches. In a museum in London is preserved a section of ship-planking a foot square which incloses the broken ends of three "swords" of these fish, driven in during a joint attack on a vessel.

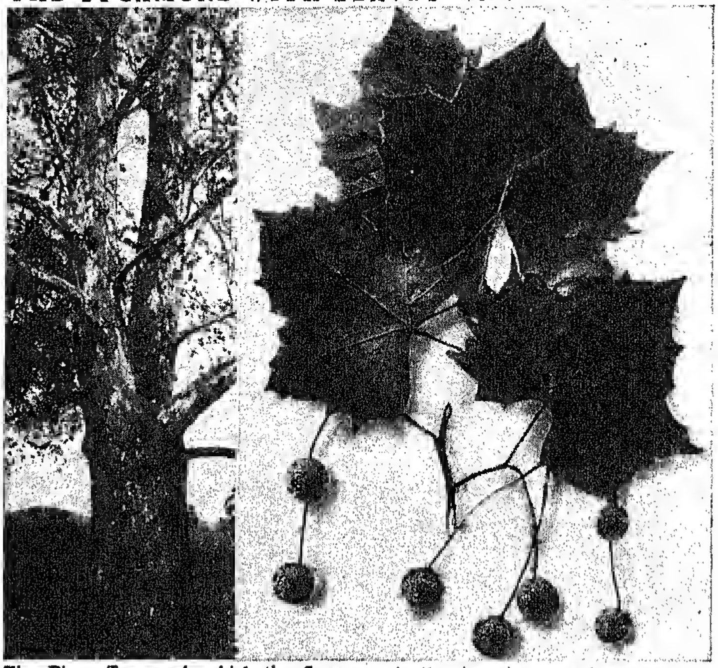
Swordfish are much sought as food. Several thousand are taken every year off the New England coast.

Another beaked monster of the sea is the sailfish, a near relative of the swordfish, although it is placed in the separate family, *Istiophoridae*. This fish is named from his sail—a huge, spotted dorsal fin, which can be raised or lowered along the back at will. What a sight it is to see this great fellow, from six to eight feet long, leaping far into the air, again and again, as if he were made of steel springs! These inhabitants of semi-tropical seas are very rapid swimmers. Often they may be seen among smaller fish along reefs, furiously lashing their long, bony beak about, disabling and then feasting on their unfortunate victims. The swordfish and sailfish give hours of thrilling sport and battle to the skilled anglers who hunt these big monsters with the rod and reel. The scientific name of the swordfish is *Xiphias gladius;* of the common sailfish, *Istiophorus nigricans*.

SYCAMORE. One of the largest and most luxuriant of forest trees is the sycamore, or buttonwood, names by which the species of plane-tree native to the United States is commonly called. It is found along the banks of streams and in rich bottomlands throughout the country, but is most abundant and attains its largest size in the valleys of the lower Ohio and Mississippi rivers.

The sycamore is a rugged handsome tree, from 70 to 120 feet high, with occasional giants 150 feet high. It is often divided near the ground into several secondary trunks, with spreading limbs at the top which form an irregular open head. The old bark flakes off in irregular brownish sheets, exposing the smooth greenish-white new bark in mottled patches beneath. In winter especially the ghostly white of the trunk and limbs gives the tree a weird and striking aspect. The flaking off of the bark is explained by the fact that the bark tissue is rigid and incapable of expanding with the tree's growth, as does the bark of other trees. The broad leaves of the sycamore aro bright yellow-green above and paler below, and the fruit is a decorative round button-like ball of fluff which swings in the wind on its long stem through the greater part of the winter. The beautifully grained reddish-brown wood is used for the interior trimmings of houses, for furniture and desk trimmings, and for cigar boxes.

THE SYCAMORE WITH LEAVES AND "BUTTONS"



The Plane-Trees, of which the Sycamore is the American species, get their name from the Latin word which means flat or broad. The Sycamore thrives best in the rich alluvial soil of the river valleys in the Central Western states, where it often attains a height of 100 to 150 feet, and a diameter of 10 to 15 feet.

The oriental plane-tree, sometimes planted in parks, is a native of Greece and western Asia. It was a favorite shade tree of the ancient Greeks and Romans and was introduced by the latter into southwestern Europe.

Scientific name, *Platanus occidentalis*. Bark reddish brown on lower part of tree, smooth and light gray above. Wood heavy, weak, difficult to split. Leaves alternate, 4 to 9 inches long, 3- to 5-lobed; petioles long, abruptly enlarged at base and inclosing the buds; fruit, brown ball an inch in diameter.

SYDNEY, AUSTRALIA. It is a holiday, and Sydney, the first city of Australia in age, size, and importance, has gone by motor, street-car, train, and boat to the shore, the woods, or the zoölogical or botanical gardens for a picnic, the universal recreation of Australia, where the day laborer is king and you cannot get your hair cut on Saturday afternoon because the barbers are playing cricket.

Easy-going Sydney lives a full life in which sports and pleasure loom large, perhaps because of the mild climate of New South Wales, of which it is the capital. At countless beaches and in magnificent parks that know no "keep off the grass" signs, Sydney is "taking an airing," sailing a boat, fishing, riding the surf, playing games, eating, studying, gossiping, reading, sewing, writing letters, or just "plain resting." On a "metropolitan cup day" at the race course, which is as much a part of every large Australian community's equipment as a cemetery, the streets are crowded, and hotels are packed.

Capt. James Cook, sailing past the jutting capes that guard the Sydney harbor a little over 150 years ago, could hardly have foreseen that this port would become one of the British Empire's great cities surpassing even Liverpool in size. The harbor, called Port Jackson, with "deep water fingers stretching miles inland between wooded banks" is one of the finest and most beautiful in the world, providing nearly 200 miles of waterfront. One of the world's longest arch bridges spans its channel, and swift ferries dart about carrying folk to suburbs fringing the bays and coves. Great ocean vessels call at the wharves for the wheat, flour, frozen meat, wool, hides, fruit, gold, silver, lead, copper, and other products Australia sends to this commercial and shipping center for export. Sydney's industrial plants, run by fuel from its surrounding coal basin, produce a good share of the country's manufactured goods.

It is an up-hill and down-dale city of magnificent proportions with parks on every hand, no slums, and many imposing buildings. Especially fine are those of the University of Sydney, which heads the numerous institutions that make the city an educational center. Population of the metropolitan area (including many suburban municipalities), about 1,130,000.

SYRACUSE, N. Y. Automobile gears, differentials, and transmissions, candles, china, agricultural implements, shoes, typewriters, soda ash, tool steel, the Iroquois Indians, the Ice Age—all these should make you think of Syracuse, which presents as many varied points of interest as any city of its size in the United States. Like most of the cities along the old Erie Canal route, Syracuse is a city of varied industries. It is not only a leader in the products mentioned above, but it also makes many other things, including electrical appliances, air-conditioning equipment, furniture, cement, powdered milk, and mincemeat.

The salt springs at this site were known to the Indians and were worked by early settlers. Although Syracuse was once the "salt cellar of the nation," this industry has disappeared. But since the region abounds in limestone as well as salt springs, the Solvay process of making soda ash from salt has created important works in surrounding villages, where ammonia, coke, carbolic acid, and other coal-tar products are manufactured.

Syracuse takes pride in its civic efficiency and betterment work, and calls itself "the city of contented workmen." It is the seat of Syracuse University and the affiliated State College of Forestry.

The city is situated on Onondaga Lake, at the foot of the Onondaga Valley. The Onondaga Indians were the "keepers of the council fire" in the Long House of the dread Six Nations, and the remnants of the tribe live on a reservation of about 7,000 acres six miles south. The New York State Barge Canal passes through Syracuse along a route known to readers of James Fenimore Cooper as "the Pathfinder's Trail." An even more ancient route is that through which the Lackawanna Railroad runs southward out of Syracuse, for this follows the channel of an ancient glacier. Population (1940 census), 205,967.

SYRIA. Though the name Syria today is commonly restricted to the part of Turkey which was put under French mandate in 1920, in the wider geographical and historical sense it includes Palestine as well. This ancient Syria is the narrow strip of land extending along the western edge of the Arabian peninsula, as far north as the Taurus Mountains, with the Mediterranean on one side and the desert on the other. Syria forms a bridge between Africa and Asia, between two ancient homes of civilization, the valleys of the Nile and the Euphrates. So, too, it is a link between East and West, a great highway of civilization, a battle-ground between empires.

A STREET IN ALEPPO

This is a typical scene in a Syrian city. Notice the flying buttresses which prop up the walls, the grilled windows, even on the second story, and the brick-and-mortar dove-cotes on top of the houses. You can readily see why there is little wheeled traffic in such narrow streets.

Look at Syria in another way and you see it as the western wing of the semi-circle of fertile land which fringes the Arabian desert, extending from the southeast corner of the Mediterranean to the Persian Gulf—the region which has come to be known as the Fertile Crescent. There are many dry places even in Syria, but to the Canaanites and other tribes that drifted into it from the desert it was a garden land. Within it are contained the rich valleys of the Lebanon Mountain region, where the Phoenicians made their home; the verdant Plain of Esdraelon, in Palestine, the land of the Israelites; and the fertile Plain of Sharon to the southeast, which was the country of the ancient Philistines. Northern Syria was the abode of the Arameans, who were in very ancient times the merchants and traders of the Eastern world. Their widespread trade connections carried their language, the Aramaic, far and wide until it became the common business tongue of the entire Fertile Crescent. In time it even displaced its sister tongue, the Hebrew of Palestine, and thus became the speech of Jesus and the Jewish people of his time in Palestine.

Except for the Hittites and the Philistines, who became merged with the other peoples, these tribes which made up the population of Syria in ancient times were Semites. And although Greeks, Romans, Turks, Kurds, and European crusaders have blended with the original stock, the Syrians of today are still mainly Semitic and the language of the country is Arabic, a Semitic language which is related to the ancient Hebrew.

In spite of this racial kinship, however, these various tribes have never united to form a strong nation. This is due, doubtless, in part to their natural character, and in part to the fact that Syria is broken up

by desert and mountain into a number of petty provinces, but most of all to the fact that Syria, placed between strong rival powers, was forced to play the part of a buffer state, subject to alien rule.

Syria is the home of many religions and sects. The Mohammedans are in the majority, although there are also great numbers of Christians and Jews. Among the many strange sects are the Mohammedan Druses, noted for their hatred of the Christian sect called the Maronites, numbering about 300,000 and under the jurisdiction of the pope, but with many special observances and privileges.

SYRIANS MARKETING A CROP OF SILK COCOONS

The expert with his hands full of silk cocoons can judge their quality by their feel. France buys large quantities of cocoons from Syria.

After having passed through the hands of the Assyrians, the Babylonians, the Persians, the Macedonians under Alexander the Great, and the Romans, Syria was conquered in the 7th century A.D. by the Arabs. In 1099 the Crusaders established the kingdom of Jerusalem and the principality of Antioch, but they were driven out in the latter part of the 12th century by Saladin, sultan of Egypt. In 1516 Syria was conquered by the Ottoman Turks, who remained in possession until expelled by British troops during the World War of 1914–18. At the peace conference the Arab claim was overruled and the mandate for Syria, exclusive of Palestine, was given to France.

For a few years the French, in spite of Syrian national aspirations and Turkish attempts to regain control in the north, made progress in setting up an administration similar to that maintained in Africa. The attempt of Emir Faisal to set up a Syrian monarchy was defeated (1919–20), banditry was suppressed, and Turkey, after a year of fighting, was placated by the Treaty of Angora (Oct. 20, 1921), which gave her a strip along the northern edge, including the Bagdad railway from a point near Aleppo eastward. In 1921 General Gouraud, the French High Commissioner, also set up autonomous limited governments in Lebanon and in the Jebel (meaning "mountain") Druse district southeast of Damascus, and made progress in developing roads, motor caravans, and industry. This policy was continued by General Weygand in 1924, and although Syrian charges of oppression and governmental extravagance continued, progress seemed steady until the appointment of General Sarrail as commissioner in 1925. Sarrail's tactics stirred the Druses to revolt, and after some successes against French forces they moved on Damascus. After local riots there, Sarrail bombarded the Mohammedan quarter (October 18–20) with heavy loss of life. After his recall, peace was restored, though the struggle for independence continued.

Following the defeat of France in the second World War, there was large-scale German infiltration into Syria. Great Britain and "Free France," to meet this threat, sent troops into Syria. After brief armed resistance, France in 1941 agreed to an armistice providing for allied occupation.

Even with the primitive agricultural methods still practised, Syria produces considerable crops of small grains, fruit, hemp, indigo, and tobacco. The horses are splendid creatures but the cattle of the region are small and insignificant.

Among the leading cities are Beirut, an important seaport, and the seat of a large American missionary college; Aleppo (Haleb), which is again becoming a great commercial center, as it was in ancient times; Antioch (Antakiyeh), noted as one of the chief centers of early Christianity; Jerusalem; and Damascus, the largest city and one of the most ancient cities in the world. The total population of Syria is over 3,000,000. (*See also* Palestine.)

Syringa (*sĭ-rĭn'ga*). In popular usage this name is applied to a hardy flowering shrub often seen in gardens, also known as the false syringa or mock-orange (*Philadelphus coronarius*). A native of western Asia and perhaps of some parts of southern Europe, it has become widely distributed through cultivation. It grows as a spreading bush from two to ten feet high, with smooth ovate leaves and cream-colored fragrant flowers, somewhat resembling orange blossoms, and growing in clusters. The name syringa is also given to a genus of Old World shrubs of the olive family, to which the lilac belongs.

THE EASY REFERENCE FACT-INDEX

GUIDE TO ALL VOLUMES FOR SUBJECTS BEGINNING WITH

S

TO SAVE TIME

USE THIS INDEX ☞

EDITOR'S NOTE ON NEXT PAGE TELLS WHY

S-Z-X

SPECIAL LISTS AND TABLES

Numerous other lists and tables in the fields of geography, history, literature, science, mathematics, and other departments of knowledge will be found with their appropriate articles in the main text

EDITOR'S NOTE

EVERY user of Compton's Pictured Encyclopedia should form the habit of *first* turning to the Fact-Index section at the end of each volume when in search of specific information. This index is a miniature work of reference in itself and will often give you directly the facts, dates, or definitions you seek. Even when you want full treatment of a subject, you will usually save time by finding in the index the exact page numbers for the desired material.

All page numbers are preceded by a letter of the alphabet, as A-23. The letter indicates the volume. If two or three page numbers are given for the topic you are seeking, the first indicates the more general and important treatment; the second and third point to additional information on other pages. Where necessary, subheadings follow the entry and tell you by guide words or phrases where the various aspects of the subject are treated.

The arrangement of subheadings is alphabetical, except in major historical and biographical entries. In these the chronological order is followed.

The pictures illustrating a specific subject as a rule appear on the same pages as the text to which you are referred. But often illustrations placed elsewhere will prove of additional interest and value. These are indicated by the word *picture* followed by a page number.

A picture reference is frequently intended to call attention to details in the text under the illustration as well as to the illustration itself. This picture-text, therefore, should always be carefully read.

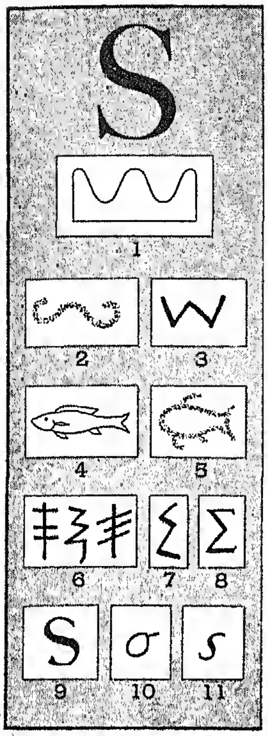
The pronunciations given are those preferred by the best and most recent authorities; alternative pronunciations are indicated only where usage is equally divided. For foreign names the native pronunciation is given except where the English pronunciation has become thoroughly established, as in "Paris," "Barcelona," "Seine."

In recent years hundreds of foreign geographical names have been changed, either officially or by custom. Both old and new names are given at the appropriate places in the alphabet.

Populations are given in round numbers, except for places in the United States and Canada, where the figures are those of the latest official census. Distances between points are map or air distances, not distances by railroad.

THE EASY REFERENCE FACT-INDEX

Reg. U. S. Pat. Off.



OUR LETTER S has gone through many changes, because the peoples who developed alphabetic writing invented signs for several combinations of the 's' sound with other sounds. This variety of signs caused much confusion before our letter 's' became firmly established.

The confusion started soon after 2000 B.C., when a Semitic people called the Seirites adopted several pictures from Egyptian writing for use as alphabetic signs. The first picture (1) meant 'dunes' or 'desert' to the Egyptians; but the Seirites used it as a sign for the sound of 's' or 'sh', because to them the sign looked like a *shin* or camel's tooth. Their crude sign (2) passed into the later Canaanite-Phoenician alphabet with the curves sharpened into angles (3).

The Seirites also developed another sign for 's' from an Egyptian fish (4) because of their word *samekh* or *semket* for 'fish'. The Canaanite-Phoenician script changed the Seirite picture of a fish (5) into something more like fishbones (6), or a trellis to support grapevines. All Semitic languages gave these two signs names somewhat like the Hebrew term *shin* for the tooth sign, and *samekh* for the fishbones.

When the Greeks learned writing from the Phoenicians, they used the *shin* sign for 's', but turned it sidewise (7). Later they made it more gracefully (8). But though they took their 's' sign from *shin*, they named the sign *sigma*, from *samekh*. The actual sign for *samekh* meanwhile became the forerunner of our 'x', as told in the Fact-Index article on X.

When the Romans learned to write in Greek fashion, they took the Greek *sigma* but rounded it and left off the bottom stroke. This gave the Latin S (9). From Latin the sign for capital S came without change into English.

The small handwritten 's' has taken many forms, but the forms used today come from the Greek shapes within a word (10), and at the end (11).

NOTE.—For the story of how alphabetic writing began and developed, *see* the articles Alphabet; Writing.

Saadi. *See in Index* Sadi

Saale (*zäl'lü*) **River,** in central Germany; flows n. 250 mi. to Elbe River: *map* G-66

Saalfeld (*zäl'fĕlt*), old German town on Saale River, 60 mi. s.w. of Leipzig; ruined Sorbenburg castle said to have been built by Charlemagne; French defeated Prussians 1806.

Saanen goat, an important milk-giving Swiss breed; named for Saanen Valley of Switzerland; color pure to creamy white; hair short; first imported into U.S. in 1904.

Saar (*zär*), **Louis Victor** (1868–1937), Dutch composer and teacher; studied at Munich Conservatory; accompanist, Metropolitan Opera, New York City, 1892–95; teacher, Cincinnati College of Music, 1906–17, then at Chicago Musical College.

Saar (*zär*) **Basin,** or **Saarland,** valley of Saar River in w. Germany along Lorraine boundary; 737 sq. mi.; pop. 865,000; after 1st World War administered by League of Nations until 1935 when, by plebiscite, it chose to reunite with Germany rather than to remain under League of Nations control or to join France
France received coal output F-176

Saarbrücken (*zär'brük-ün*), German city on Saar River, 40 mi. n.e. of Metz; pop. 125,000; in Saar Basin; coal-mining center; scene of first action in Franco-Prussian War.

Saaremaa (*sä'rĕ-mä*), or **Saare Island,** formerly **Ösel** (*û'sĕl*), island in Baltic Sea off w. coast of Esthonia, at mouth of Gulf of Riga; 1046 sq. mi.; chief port Arensburg, pop. 5000; held by Sweden 1227–1561 when taken by Denmark; retaken by Sweden 1645; fell to Russia 1721, to Germany 1917; given to Esthonia 1918 after 1st World War; leased by Esthonia to U.S.S.R. for military base 1939: *map* E-326*d*–*e*

Saarinen (*sär'i-nĕn*), **Eliel** (born 1873), architect of modern tendencies, born Finland; influenced skyscraper design in U.S.; expert in city planning; director Cranbrook Academy of Art, Bloomfield Hills, Mich., after 1925, also head of department of architecture there.

Saba (*sä'bä*), volcanic island in Dutch West Indies, included in colony of Curaçao; 5 sq. mi.; pop. 2000; shipbuilding.

Sabaki River, in Kenya Colony, Africa; flows into Indian Ocean; 400 mi. long: *map* E-139

Sabatini (*sä-bä-tē'nē*), **Rafael** (born 1875), British novelist and dramatist, born Jesi, Italy; proficient in many languages, preferred to write in English; colorful historical romances ('Scaramouche'; 'Captain Blood'; 'The Sea Hawk').

Sabbath S-1
American Colonies A-167: first Puritan service, *picture* A-150

Sabbath, witch W-127

Sabbatical year, in ancient Hebrew law, every seventh year during which fields were to lie fallow. Term now applied to a year's vacation awarded to teachers.

Sa'ber S-359

Saber-toothed tiger, prehistoric mammal characterized by enlarged and elongated upper canines; remains found with those of early man; *Smilodon* an important genus: *picture* C-33

Sabians, religious sect in Iraq I-123

Sabin, Florence Rena (born 1871), American anatomist, born Central City, Colo.; professor of histology, Johns Hopkins University, 1917–25; member Rockefeller Institute for Medical Research 1925–38; member emeritus after 1938; made studies of lymphatic system, brain, blood corpuscles, tuberculosis; first woman elected to National Academy of Science.

Sabine (*sȧ-bēn'*) **Cross-Roads,** place 3 mi. s.e. of Mansfield, La., where Confederates defeated Federal forces and stopped Red River expedition, Apr. 8, 1864.

Sabine Lake, expansion of Sabine River in Texas 5 mi. above Gulf of Mexico; forms part of boundary between Texas and Louisiana; 20 mi. long, 9 mi. wide: *map* L-206

Sabine River, a stream flowing 400 mi. to Gulf of Mexico, forming part of boundary between Texas and Louisiana: *maps* L-206, T-56

Sabines (*sā'bīnz*), ancient tribe which lived northeast of Rome and became merged with Romans. According to legend Romulus and his followers, wanting wives, seized the Sabine women at a festival; when Sabine warriors tried to free them, the women rushed between the two forces imploring them not to fight; story often painted by artists
origin of tribe R-128

Sable, in heraldry H-281

Sable, Cape, Fla., southernmost point of U. S. mainland, *map* U-188*c*
Everglades National Park Project F-116, N-22

Sable antelope, or **roan antelope,** *picture* A-219

Sable fur M-71

Sable Island, a narrow sandy island of Nova Scotia, about 20 mi. long; scene of many shipwrecks; noted for seals and wild ponies: *map* C-50*c*

Key—cāpe, ăt, fär, fȧst, what, fạll; mē, yĕt, fērn, thêre; ice, bĭt; rōw, wȯn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;

ü=French *u*, German *ü*; *ġ*em, *ġ*o; *th*in, *th*en; *ṅ*=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); *ĸ*=German guttural *ch*

St. Vincent, British island of Windward group, West Indies; 150 sq. mi.; pop. 59,000; cap. Kingstown, on s.w. coast: *map,* inset N-150c

St. Vincent, also **São Vicente,** Portuguese island of Cape Verde group, off n.w. coast of Africa; 75 sq. mi.; cable station.

St. Vincent, Cape, promontory on s.w. extremity of Portugal extending into Atlantic Ocean; British fleet under Jervis and Nelson defeated Spanish fleet 1797.

St. Vincent College, at Latrobe, Pa.; Roman Catholic institution for men, founded 1846; arts and sciences, graduate school in philosophy and theology; training course in aviation.

St. Vincent de Paul, Society of, a Roman Catholic charitable society, founded by Antoine Frédéric Ozanam (1813–53), a French scholar; first established in U.S. in 1845, at St. Louis, Mo.: P-160

Saionji (*sī-yōn'jē*), **Kinmochi** (*kēm-mō'chē*), **Prince** (1849–1940), Japanese statesman, born Kyoto; minister to Austria 1885, to Germany 1888; minister of education 1892–96, 1898; premier 1905–07, 1910–12; president of the Seiyukai party 1903; political adviser to Emperor Hirohito.

Saipan (*sī-păn'*), island in w. Pacific, cap. of Marianas Islands under Japanese mandate; 70 sq. mi.; Japanese naval base: *map* P-10*b*

Sair, a wild sheep S-105

Sakais (*sä'kīs*), a race of the Malay Peninsula M-42

Sakakawea (*sä-kä-kä-wä'ȧ*). *See in Index* Sacajawea

Sakartvelo (*säk-ärt-vĕl'ō*). *See in Index* Georgia (Russia)

Sake (*sä'kē*), national drink of Japan made from rice; fermented by means of yeast cake called *koji;* yellowish in color; 12 per cent to 15 per cent alcohol.

Sakhalin (*sä-kä-lēn'*), or **Saghalin,** long mountainous island near e. coast of Siberia; about 29,000 sq. mi.; pop. over 400,000; s. part (Karafuto) ceded to Japan by Russia, 1905, after Russo-Japanese War; forests, fisheries: *map* J-186

Saki (*sä'kē*), a South American monkey M-229, *picture* M-227

Sakkara (*säk-kä'rȧ*), Egyptian village near Nile River 15 mi. s.w. of Cairo; pyramids.

Sakuntala (*sä-kon'tü-lȧ*), or **Shakuntala,** Sanskrit drama by Kalidasa. Sakuntala is found in her forest home by King Dushyanta who marries her and gives her a ring by which he is to recognize her when she joins him at his palace; the ring is lost and the king disowns her, but proclaims her his queen when the ring is found. Story used in Goldmark's opera.

Saladang (*sä-lä'däng*), or **seladang,** Asiatic ox C-102

Sal'adin (1138–93), chivalrous Mohammedan leader, sultan of Egypt and Syria S-11–12
built citadel in Cairo C-14
burial place D-9
Crusade against C-404
Richard I and R-103
Scott's 'Talisman' depicts S-12

Salado (*sä-lä'thō*), name of several rivers in South America
Salado del Norte, in Argentina A-280, *map* A-279

Salaman'ca, old Spanish city 110 mi. n.w. of Madrid; pop. 50,000; ancient Salmantica, captured by Hannibal; Wellington defeated French in Peninsular War (1812); beautiful medieval buildings badly damaged in Spanish civil war: *map* E-326*d*
university S-226, U-260

Sal'amander, an amphibian S-12–13
sign of Francis I I-99

Salamis (*săl'ȧ-mĭs*), Greece, barren mountainous island in Gulf of Aegina, or Saronic Gulf; 36 sq. mi.; famous for defeat of Persian fleet by Greeks in strait between island and Attic coast (480 B.C.).

Salamis, battle of S-13, P-136
Aristides at A-283
ships, type used N-56*d*
Solon urges capture S-192

Salammbô (*sȧ-lăm-bō'*), novel by Gustave Flaubert dealing with Carthaginian history; heroine Salammbô is daughter of Hamilcar Barca, Carthaginian general.

Sal ammo'niac, or **ammonium chloride** A-188
in electric dry cell E-215, *picture* E-214
formula C-171
Solvay process produces S-190

Salamvri'a River, also **Salambria** (formerly **Peneus**), chief river of Thessaly; 100 mi. long: *map* G-154
mythology H-282

Salandra (*sä-län'drä*), **Antonio** (1853–1931), Italian statesman; as premier, responsible for Italy's early neutrality and later siding with Allies in 1st World War; became senator in 1928.

Salangane (*săl'ăn-găn*), an oriental swift
edible nest S-333

Sal'ary, derivation of word S-16
high U. S. officials U-231
limited, 2d World War N-12*a*

"Salary grab," in U.S. history, popular term applied to an act to raise salaries of members of Congress, voted just before closing of Congress, 1873 (Grant's administration); so called because the incumbents whose terms were about to expire were benefited; called also "back pay grab."

Salayar (*sä-lī'ĕr*) **Islands,** a fertile group in the Netherlands Indies s. of Celebes; 270 sq. mi., of which 256 sq. mi. are occupied by Salayar Island (pop. 76,000); timber, coconuts, tobacco, indigo, cotton.

Salazar (*sȧ-lȧ-zär'*), **Antonio de Oliveira** (born 1889), dictator of Portugal P-315, *picture* D-67*d*

Sal effervescens. *See in Index* Effervescent salt

Sa'lem, Mass., historic city 13 mi. n.e. of Boston on Atlantic; pop. 41,213; state teachers college; Peabody Museum (colonial relics): *map* M-82
clipper trade A-333
Hawthorne associations H-248
homes of early settlers, *picture* A-162
origin of name M-81
Roger Williams expelled W-104
Salem Maritime Historic Site N-18
witchcraft persecutions W-128

Salem, Ohio, city 62 mi. s.e. of Cleveland; pop. 12,301; coal-mining, farming, and stock-raising region; automobile bodies, pumps, electric furnaces, china; "underground railroad" station before Civil War.

Salem, Ore., capital, 43 mi. s. of Portland on Willamette River; pop. 30,908; Willamette University; state schools for blind and deaf; lumber, paper, woolen goods, canned fruit; trade center for section growing hops, long-fiber flax and filberts: *map* O-246
capitol, *picture* O-245

Salem, Va., apple-growing center on Roanoke River, 8 mi. w. of Roanoke; pop. 5737; tannery, brick plant, meat-packing plant, hosiery mill; Roanoke College; medicinal springs.

Salem College, at Winston-Salem, N.C.; founded 1772 by Moravian church; for women; arts and sciences.

Salera'tus. *See in Index* Sodium, *subhead* bicarbonate

Salerno (*sä-lĕr'nō*), Italy, port on Gulf of Salerno; pop. 68,000; textiles; famous medieval medical school
university U-260

Sales, Saint François de. *See in Index* François de Sales, Saint

Sales tax T-17

Sal'ford, England, borough of Lancashire, practically a suburb of Manchester; pop. 223,000; cotton, iron, chemicals.

Sa'lian line, or **Franconian line,** of German emperors (ruled 1024–1125) G-71. For list, *see in Index* Holy Roman Empire

Salicaceae (*săl-ĭ-kā'sē-ē*). *See in Index* Willow family

Salicin (*săl'ĭ-sĭn*), drug obtained from willow W-105

Salic law, an early medieval law (one of the Germanic laws) of the Salian Franks, an important Frankish tribe; used as early as time of Clovis; a penal code with some rules of civil law which contain provisions against female inheritance of property; gave rise to so-called Salic law, enforced in France and various French and German kingdoms and duchies, which forbade succession to rule to females and to descendants through any female line.

Salicylic (*săl-ĭ-sĭl'ĭk*) **acid,** an antipyretic (fever-allaying) drug ($C_6H_4 \cdot OH \cdot COOH$)
made from carbolic acid C-259

Salina (*sȧ-lī'nȧ*), Kan., railroad city on Smoky Hill River, 105 mi. w. of Topeka; pop. 21,073; ships grain; flour, farm machinery, packing house products; Kansas Wesleyan University, Marymount College: *map* K-4

Salina Cruz (*sä-lē'nä kroos*), Mexico, Pacific port on Gulf of Tehuantepec; pop. 6000; terminal of railroad across isthmus of Tehuantepec: M-142, *map* M-133

Salinas (*sȧ-lē'nȧs*), Calif., city 90 mi. s. of San Francisco in rich farming and cattle-raising section; pop. 11,586; sugar, canned fruits and lettuce, rubber products.

Salines, soluble mineral salts M-183

Salinity, of ocean water W-45

Salisbury (*sạlz'bĕr-ĭ*), **Robert A. T. Gascoyne-Cecil,** 3d **Marquis of** (1830–1903), British conservative statesman; imperialist, premier 1885–86, 1886–92, 1895–1902; descendant of Queen Elizabeth's great minister, Burleigh; chief political adviser, with Joseph Chamberlain, to Queen Victoria after death of Disraeli.

Salisbury, England, town on Avon River, 80 mi. s.w. of London; pop. 26,000; one of finest cathedrals in England; formerly known for woolens and cutlery; trade center: *map* E-270*a*

Salisbury, Md., city on Wicomico River 83 mi. s.e. of Baltimore; pop. 13,313; lumber, shirts, foundry products, yachts; state teachers college: *map* M-78

Salisbury, N. H., town 15 mi. n.w. of Concord; pop. 368; birthplace of Daniel Webster.

Salisbury, N. C., city 110 mi. w. of

Key—cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wȯn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;

Salvatierra, Juan María (1648–1717), Italian Jesuit missionary, born Milan, Italy; in 1697 founded mission at Concepción Bay on east coast of Lower California.

Salvation Army S-19–20

Salvator Rosa. *See in Index* Rosa

Salvemini (*säl-vä'mē-nē*), **Gaetano** (born 1873), Italian historian; professor of history University of Florence; edited Liberal newspaper *L'Unità*; left Italy, 1925; embittered opponent of fascism.

Salverson, Laura Goodman (born 1890), Canadian novelist and short-story writer; 'The Viking Heart' pictures realistically the lives of Icelanders living in Canada; 'Confessions of an Immigrant's Daughter', autobiography.

Salvia, or **scarlet sage,** a genus of plants and shrubs of the mint family; about 500 species; flowers tubular, scarlet, white, and shades of blue.

Salvini (*säl-vē'nē*), **Tommaso** (1829–1915), Italian actor; famous on Italian, English, and American stages; chief successes in 'Oreste'; 'La Morte Civile'; 'Francesca da Rimini'; 'Othello'.

Sal volatile, ammonium carbonate A-188

Salween' River, or **Salwin,** in southern Asia; rises in s.e. Tibet and flows 1750 mi. s., principally through Burma, to Gulf of Martaban: B-278*a*, 279, *maps* I-30, A-332*e*

Salzburg (*zälts'burκ*), Germany, picturesque city in Salzburg Alps in Ostmark, 155 mi. w. of Vienna; pop. 38,000; capital of Salzburg province (2762 sq. mi.; pop. 265,000); castle, cathedral, and many other fine buildings; home of Mozart; annual music festival: A-378, *map* A-361

Salzburgers, German Lutheran immigrants (about 135) to colony of Georgia (1734–35), seeking religious liberty; first settled near Springfield, moved to New Ebenezer; thrifty and industrious, contributed to growth of silk weaving industry before American Revolution.

Samar (*sä'mär*), 3d largest of Philippine Islands; 5124 sq. mi.; principal crops, Manila hemp (abaca) and coconuts: *maps* A-332*e*, P-10*b*

Samara, Russia. *See in Index* Kuibishev

Samaria (*sȧ-mâ'ri-ȧ*), ancient city of Palestine, 35 mi. n. of Jerusalem; became capital of Israel 9th century B.C. (Name also applied to region of central Palestine occupied by Samaritans)
Assyrians capture J-216

Samaria, battle of, during 1st World War, at Samaria, Palestine, September 19–22, 1918; British and Arabian troops under General Allenby defeated Turkish forces.

Samar'itans, a people of Palestine
modern, *picture* P-34
origin J-216

Sama'rium, a chemical element, *table* C-168

Samarkand (*sä-mär-känd'*), also **Samarqand,** U.S.S.R., cent. Asiatic city in Uzbekistan, 120 mi. e. of Bokhara; pop. 135,000; ancient Maracanda; famous medieval center of learning: T-158, *map* A-332*b*

Samar'off, Olga (born 1882), pianist, born San Antonio, Tex.; of German and Russian descent; married Leopold Stokowski 1911, divorced 1923; retired in 1925 from successful concert career after injury to wrist.

Samarra (*sä-mär'rä*), Iraq, town on Tigris River, 60 mi. n.w. of Baghdad; place of pilgrimage for Mohammedans of Shiite sect; pop. about 8000
tower, *picture* M-121

Sambiki-saru, the Three Mystic Monkeys of Japan, *picture* M-231

Sambre (*säṅ'brŭ*), river in n.e. France and Belgium; rises 120 mi. n.e. of Paris and flows 100 mi. n.e. to Meuse at Namur: M-131, *map* B-87

Sam Browne belt U-180, *picture* U-178

Sam'nites, ancient warlike tribes inhabiting mountainous portions of s. half of Italy R-132

Samoa (*sä-mō'ȧ*), chain of islands in southern Pacific, formerly called Navigators Islands; more than 1200 sq. mi.; pop. 70,000: S-20, *map* P-10*c*
German intervention H-230
government: British N-136; United States U-226
natives, *pictures* P-2, 7
shelter, *picture* P-7
Stevenson in S-288
U.S.navy base, *map* N-52, *picture* P-10*d*

Samos (*sā'mŏs*), small Greek island in Aegean Sea near Asia Minor; pop. 70,000; flourishing Greek colony 6th century B.C.; famous temple of Hera; exports wine, raisins: *map* B-18

Sam'oset (died about 1653), American Indian chief, friend of Puritans at Plymouth P-261

Sam'othrace (Greek **Samothrake**), small mountainous Greek island in n. Aegean; 'Winged Victory' found here 1863, now in Louvre.

Samothrace, Victory of. *See in Index* Winged Victory

Samovar (*săm'ō-vär*) (Russian, meaning a "self-boiler"), a metal urn to hold water for making tea; glowing charcoal, placed in a pipe passing through the center, boils the water and keeps it hot.

Samoyed (*săm-ō-yĕd'*), tribe living on Arctic coast between Petchora and Yenisei rivers; hunting, fishing, reindeer; stone huts; implements of bone and stone
racial affinity, *diagram* R-9*b*

Samoyed dog, a Spitzlike dog, first used by Samoyeds: D-83

Samp, coarse hominy C-368

Sam'pans, small flat-bottomed boats of China and Japan; often used by Chinese as house-boats: A-330, C-216, C-79, *pictures* C-216, F-139

Sampler, a piece of embroidery, generally worked on canvas or other coarse material, *picture* A-167

Sampling, in advertising A-24

Sampling, statistical method G-136*g–h*

Samp'son, William Thomas (1840–1902), American rear admiral, born Palmyra, N. Y.; served in Civil War; in Spanish-American War, had charge of the North Atlantic squadron and conducted the blockade of Santiago, Cuba; the battle of Santiago was fought according to his plans, though he was absent at the time conferring with army leaders: S-235, *picture* S-234

Sam'son, Hebrew judge and hero, celebrated for feats of strength. When Delilah had his locks shorn, his strength departed and he was enslaved and blinded by the Philistines. As his hair grew, his strength returned and he pulled down the house on his enemies' heads and his own (Judges xiii–xvi).

'Samson Agonistes' (*ăg-ō-nĭs'tēz*), tragedy by Milton M-180

'Samson and Delilah', opera by Saint-Saëns, story O-233

Samsun (*säm-soon'*), seaport of Asiatic Turkey on s. coast of Black Sea; about 380 mi. e. of Constantinople; district a principal source of Turkish tobacco; ancient Greek city, Amisus, stood 1½ mi. n.w.; exports cereals, tobacco, olives, wool; pop. 33,000: *maps* B-154, E-326*e*

Sam'uel, last of Hebrew judges; anointed Saul and David (I Samuel); gave name to 9th and 10th books of Old Testament containing history of Israel from the birth of Samuel to the death of David
meaning of name N-2

Samuel, Harold (1879–1937), English pianist, celebrated as one of greatest players of Bach's music.

Samuel, Herbert, first Viscount (born 1870), British Liberal politician; postmaster general 1910–14 and 1915–16; high commissioner to Palestine 1920–25; home secretary 1916 and 1931–32.

Samuels, Mrs. Homer. *See in Index* Galli-Curci, Amelita

Samurai (*sä'mu-rī*), feudal warriors of Japan J-191
jiu-jitsu W-183

GUN SALUTES—UNITED STATES

48 guns. Salute to the Union, commemorative of the Declaration of Independence. One gun for each state is fired at noon July 4 at every U. S. military post and on board every U. S. commissioned naval vessel.

21 guns. Salute given to national flag, president of the U. S., ex-presidents of the U. S., presidents and sovereigns of foreign countries, and members of royal families.

19 guns. Salute given to vice-president of the U. S., members of U. S. Cabinet, president *pro tempore* of U. S. Senate, foreign ambassadors, foreign high commissioners with rank of ambassador, chief justice of U. S. Supreme Court, and the general of the U. S. Army.

17 guns. Salute given to assistant secretaries of war and navy, governor general of the Philippines, governors or viceroys of territories of foreign powers, speaker of U. S. House of Representatives, a committee of Congress, chief of staff of the U. S. Army, former chiefs of staff, generals of the U. S. Army, admirals of the U. S. Navy, and foreign officers with corresponding ranks.

15 guns. Salute given to territorial vice-governors, American envoys and ministers plenipotentiary, foreign envoys and ministers plenipotentiary accredited to the U. S., lieutenant generals in the U. S. Army, vice-admirals in the U. S. Navy, and foreign officers with corresponding ranks.

13 guns. Salute given to American ministers resident, foreign ministers resident accredited to the U. S., major generals in the U. S. Army, rear admirals in the U. S. Navy, and foreign officers with corresponding ranks.

11 guns. Salute given to American chargés d'affaires, foreign chargés d'affaires accredited to the U. S., brigadier generals in the U. S. Army, foreign officers with equivalent rank, consuls general of the U. S., and foreign consuls general.

7 guns. Salute given to consuls of the U. S. and foreign consuls to the U. S.

5 guns. Salute given to vice-consuls of the U. S., foreign vice-consuls, and consular agents of the U. S. and foreign powers.

ü=French u, German ü; ġem, ġo; thin, *th*en; ṅ=French nasal (Jeaṅ); zh=French j (z in azure); κ=German guttural ch

ü=French *u*, German *ü*; ġem, ḡo; thin, *th*en; ṅ=French nasal (Jeaṅ); zh=French *j* (z in azure); ĸ=German guttural *ch*

ü=French *u*, German *ü*; *ġ*em, *ḡ*o; *th*in, *th*en; *ṅ*=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); *ĸ*=German guttural *ch*

Scarlet maple, red maple, or swamp maple M-56

Scarlet runner, a beanplant B-67

Scarlet tanager, a bird T-8, *color plate* B-140
molting B-130

Scarpe (*skärp*), small river in n.e. France; 25 mi. long: A-310

Scarron (*skä-rôṅ'*), **Paul** (1610–60) French poet and dramatist, husband of Madame de Maintenon: M-41

Scarsdale, N. Y., residential city 6 mi. n. of New York City; pop. 12,966; was once part of Manor of Scarsdale, established 1701.

Scar-tattooing T-16

Scavenger, in alloy making A-133

Scavenger beetle B-83, 85

Scebeli River. *See in Index* Shebeli

Scenery, stage T-76–7
Chinese C-221*g*
Elizabethan theater S-100

Scepticism. *See in Index* Skepticism

Schacht (*shäKt*), **Hjalmar Horace Greeley** (born 1877), German financier and formulator of Nazi economic policy; president Reichsbank, 1923–30, 1933–39; established Gold Bank of issue; German delegate at final settlement of reparations, Paris, 1929; wrote 'The End of Reparations'; appointed personal economic adviser to Hitler 1939.

Schadow (*shä'dō*), **Johann Gottfried** (1764–1850), German sculptor; representative of neo-classical group: S-61

Schaefer prone-pressure method, in asphyxia, *picture* F-63

Schaffhausen (*shäf-hou'zĕn*), Switzerland, capital of canton of same name, 24 mi. n. of Zurich; site of famous falls of the Rhine River; pop. 21,000.

Schäffle (*shĕf'lŭ*), **Albert Eberhard Frederick** (1831–1903), German sociologist and economist; professor at Tübingen and Vienna; influenced by Hegel, Darwin, and others; interested in socialism ('The Quintessence of Socialism').

Schall (*shäl*) **von Bell, Johann Adam** (1591–1666), Jesuit missionary, born Cologne, Germany; went to China 1628 and established flourishing mission at Shensi; later called to Peking by Emperor Shun-chi where he directed the public mathematical school and was created a mandarin. At death of Shun-chi (1661) a change of policy toward Christianity caused him to be imprisoned; he was released but died shortly afterward
corrects Chinese calendar C-221*k*

Scharn'horst, Gerhard Johann David von (1755–1813), Prussian general, one of founders of Prussian military system (1809–13); fatally wounded at battle of Lützen.

Scharwenka (*shär-vĕng'kä*), **Franz Xavier** (1850–1924), German composer, born Samter, Posen; established conservatory in Berlin, where brother Philipp was associated with him; also conservatory in New York; compositions for orchestra and brilliant piano pieces.

Scharwenka, Philipp (1847–1917), German composer, born Samter, Posen; brother of Franz Xavier ('Sakuntala').

Schaumburg-Lippe (*shoum'burK-lip'ŭ*), state in n. Germany, formerly principality; 131 sq. mi.; pop. 48,000.

Scheele (*shä'lŭ*), **Karl Wilhelm** (1742–86), Swedish chemist, born Stralsund, Pomerania; discovered oxygen before Priestley, but failed to publish his work until after Priestley's announcement; discovered tungsten in the form of tungstic acid, also molybdic and arsenic acids.

Schee'lite, a tungsten ore T-150, M-183

Scheer (*shār*), **Reinhard** (1863–1928), German admiral in 1st World War; chief of admiralty staff 1918; advocated more extensive use of submarines
commanded at battle of Jutland W-158

Schef'fel, Joseph Victor von (1826–86), German poet and novelist ('Der Trompeter von Säckingen'; 'Ekkehard').

Scheherazade (*shĕ-hä-rä-zä'dĕ*), in the 'Arabian Nights', wife of the sultan and narrator of the tales: A-243–4

Scheidemann (*shī'dŭ-män*), **Philipp** (1865–1939), German Socialist leader, first chancellor of German republic (1919); exile after 1934.

Scheik, famous diamond, *picture* D-63

Scheldt (*skĕlt*) **River,** also **Schelde,** an important navigable river of Belgium rising in France and flowing 250 mi. to North Sea: S-38, *map* B-87
Antwerp commerce A-224
delta N-66

Schelling (*shĕl'ing*), **Ernest Henry** (1876–1939), American pianist, composer, and conductor, born Belvidere, N. J.; conductor of children's concerts of New York Philharmonic-Symphony Orchestra ('Légendes Symphoniques'; 'Victory Ball').

Schelling, Friedrich Wilhelm Joseph von (1775–1854), German philosopher G-63

Schenectady (*skĕ-nĕk'tä-dĭ*), **N. Y.,** industrial city on Mohawk River and New York Barge Canal; pop. 87,549: S-38, *map* N-114

Schenley Park, Pittsburgh P-225, 226

Scheria (*skē'rĭ-ȧ*), **Island of,** in 'Odyssey', home of Phaeacians; probably Corfu: O-205

Scherzo (*skĕr'tso*) (Italian for "jest"), in music, a sportive, vivacious piece or movement of a sonata or symphony; usually in triple time
place in symphony M-313

Scheveningen (*sKā'vĕn-ing-ĕn*), a fishing port and watering place of the Netherlands on North Sea, near The Hague: N-69, *map* B-87

Schick, Bela (born 1877), Hungarian bacteriologist; devised Schick test for diphtheria (1913); came to U. S. in 1923; chief pediatrist at Mount Sinai Hospital, New York City
Schick test A-224

Schiedam (*sKē-däm'*), Netherlands, river port near mouth of Meuse River 4 mi. w. of Rotterdam; pop. 48,000; numerous canals; distilleries, trade in gin, grain.

Schiff (*shĭf*), **Jacob Henry** (1847–1920), American financier and philanthropist, born Germany; aided in reorganizing Union Pacific Railroad 1897 and in financing other railroads; founded Jewish Theological Seminary, New York, Semitic Museum at Harvard University; active in charitable and civic work.

Schiller (*shĭl'ĕr*), **Ferdinand Canning Scott** (1864–1937), English philosopher; exponent of pragmatism; professor philosophy University of Southern California 1929–36 ('Humanism'; 'Eugenics and Politics'; 'Must Philosophers Disagree?').

Schiller, Johann Christoph Friedrich (1759–1805), German poet and dramatist S-39, *picture* G-60
friendship with Goethe G-110
Weimar, home and monument W-69–70

Schilling, Johannes (1828–1910), German sculptor; chief works include Schiller statue in Vienna; German national monument opposite Bingen; statues of Emperor William I and Bismarck at Wiesbaden.

Schilling, former monetary unit of Austria, nominally worth 23.8 cents in U.S. money.

Schipa (*skē'pä*), **Tito** (born 1889). Italian dramatic tenor; favorite in Europe and U. S. ('Rigoletto'); sang with Chicago and Metropolitan Opera companies.

Schipperke (*skip'ĕr-kē*), a small dog D-83

Schism. *See in Index* Great Schism

Schist (*shĭst*), rock formed by recrystallization of shale M-184, R-121

Schizanthus (*skĭ-zăn'thŭs*), a small genus of annual or biennial plants of the nightshade family, native to Chile. Leaves finely cut; flowers orchid-like, white through purple, in clusters; also called butterfly-flower and poor man's orchid.

Schizomycetes (*skĭz-ō-mī-sē'tēz*), class of plants including all the bacteria B-205

"Schlag Tag" (*shlăg tăg*), Swedish game P-254, *picture* P-254

Schlegel (*shlā'gl*), **August Wilhelm von** (1767–1845), German critic, poet, and translator; his translations of Shakespeare one of the best made in any language; responsible for great popularity of Shakespeare in Germany.

Schlegel, Karl Wilhelm Friedrich von (1772–1829), German critic, scholar, and poet, considered leader of romantic movement; demanded complete individual freedom; brother of A. W. von Schlegel ('Lectures on Modern History'; 'Lectures on the History of Literature').

Schleiden (*shlī'den*), **Matthias Jakob** (1804–81), botanist, born Hamburg, Germany; taught at Jena and at Dorpat; later carried on private research; helped to establish fact that the cell is the structural unit of plants and animals.

Schleiermacher (*shlī'ĕr-mä-Kĕr*), **Friedrich Ernst Daniel** (1768–1834), German theologian and philosopher; combined emotional religion with a logical philosophy; held Christianity was a thing to be felt; his works have had a great influence on modern theology.

Schleswig-Holstein (*shlās'vĭK hōl'-shtīn*), Prussian province in Danish peninsula; 5805 sq. mi.; pop. 1,520,000: D-53, *maps* D-53, G-66
Prussia controls B-148
school gardens S-41

Schley (*slī*), **Winfield Scott** (1839–1911), American naval officer, born near Frederick, Md.; graduated U.S. Naval Academy; served in Civil War; commanded expedition which rescued the explorer, Greely, in 1884; located and blockaded Spanish fleet in Spanish-American War until relieved by Admiral Sampson; in actual command at naval battle of Santiago July 3, 1898; made rear admiral at end of war: *picture* S-234

Schleyer (*shlī'ĕr*), **Johann Martin** (1831–99), German priest, inventor of Volapük E-303

Schlieffen (*shlē'fĕn*), **Alfred, Count von** (1833–1913), German soldier;

ü=French *u*, German *ü*; *ġ*em, *ḡ*o; thin, *th*en; ṅ=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); K=German guttural *ch*

Key—cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wȯn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;

ü=French *u*, German *ü*; *ǧem, g̃o*; *th*in, *th*en; *ṅ*=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); *ĸ*=German guttural *ch*

Key—cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wȯn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;

ü=French *u*, German *ü*; ĝem, ĝo; *th*in, *th*en; ṅ=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); κ=German guttural *ch*

Shale, a stratified rock resembling slate S-158
becomes clay when ground C-260
chief varieties M-184
covers natural gas fields G-24
formed in the sea R-121
oil yielding, *picture* P-147: Manchuria M-51, 52
origin G-39: Proterozoic era G-40

Shaler, Nathaniel Southgate (1841–1906), American geologist, born Newport, Ky.; professor at Harvard University 1868–87; dean of Scientific School, 1891 ('First Book in Geology'; 'Man and the Earth').

Shallot', plant of onion genus O-225

Shallow, Justice, in Shakespeare's 'Merry Wives of Windsor', a self-important, foolish, ignorant country magistrate.

Shallu (*shä'lų*), a grain sorghum; introduced into U. S. from India 1890; stalks dry and pithy; of slight economic importance.

Shalmaneser II (or **III**) (*shăl-mä-nē'zẽr*), King of Assyria, 858 B.C. to 823 B.C.; reign marked by constant campaigns against eastern tribes; annals of reign engraved on black marble obelisk now in British Museum.

Shaman (*shä'măn*), American Indian medicine man F-10

Sha'manism, a primitive religion of the Ural-Altaic peoples living from Bering Strait to borders of Scandinavia; found in varied forms among Eskimos and American Indians; based on belief that good and evil come from ancestral spirits, gods, and demons which can be influenced by the priest or medicine man who is known as the shaman.

Shameen Island, China, foreign settlement of Canton C-79

"Shammy" leather C-138, L-84

Shamo'kin, Pa., borough 40 mi. n.e. of Harrisburg, in anthracite coal region; pop. 18,810; coal mining, textile manufacturing; railroad shops.

Sham'rock, or hop clover S-101

'Shamrock', name of Sir Thomas Lipton's racing yachts B-104

Shan-a-lin Mountains, in s. Manchuria on the Korean frontier; highest point 8000 ft.

Shandaken Tunnel, N. Y. A-236

Shang Dynasty, China (about 1700–1100 B.C.) C-221*i*

Shang'hai, China, chief seaport of n. China, near mouth of Yangtze River; pop. more than 3,000,000: S-101–2, *maps* C-211, 212, A-332*a*, *b*
harbor H-215, *picture* H-217
Japanese control C-221*n*
Yangtze River Y-203

Shanhaikwan (*shän'hī'gwän'*), Manchukuo, seaport in Chindhou province on s. border of Manchukuo; on railway between Mukden and Tientsin; pop. about 80,000: *map* M-49*a*

Shannon, Monica (born 1898?), poet and author of children's books; born Ontario, Canada; Newbery medal (1935) for 'Dobry'; 'California Fairy Tales'.

'Shannon', British warship L-74

Shannon River, in Ireland, longest in British Isles; rises in s.w. Ulster and flows 240 mi. s.w. to Atlantic, traversing series of lakes; famous for salmon-fishing: *maps* E-279, E-270*a*
hydroelectric development I-130, *picture* I-131

Shans, a group of tribes of Burma, Siam, and China B-278*a*

Shansi (*shän-sē'*), a n. cent. province of China; 58,662 sq. mi.; pop. 11,600,000; cap. Taiyuan; coal, iron, copper, salt, fruit: *map* C-212
Japanese control C-221*n*

Shantung (*shän'tung'*), province on e. coast of China; 60,000 sq. mi.; pop. over 30,000,000; cap. Tsinan: S-102, C-221*l*, *m*, *map* C-212
Confucius in C-330
Japanese control C-221*n*

Shantung silk S-147, S-102

Shanty songs, songs of the American logging camp, celebrating the dangers of the life of the "shanty boy" or lumberjack. The sailor's shanty, sometimes spelled chanty or chantey, is by contrast a "work song," with a chorus designed to produce united labor: F-135–6

Shapley, Harlow (born 1885), American astronomer, born Nashville, Mo.; at Mt. Wilson Observatory 1914–21, director Harvard Observatory after 1921; investigated brilliancy and composition of stars, measured spiral nebulae, and determined distances from earth of globular star clusters and the Milky Way, thus extending the knowledge of the limits of the universe.

Shaposhnikof (*shä'pŭsh-nē-kōf*), **Boris M.** (born 1882), Russian army officer, chief of general staff of Russian army, 2d World War.

Sharaku (*shä'rä-kų*), **Toshusai** (1775?–1810?), Japanese color-print artist; started career as No dancer; noted for portraits, generally satiric, of dancers and theatrical idols of his day.

Share, of plow P-259

Share, of stock S-290

Share cropper, and share tenant. *See also in Index* Tenant farming
cotton farms C-376
farm labor problem L-44*b*

Shari (*shä'rē*) **River**, in Africa, chief tributary of Lake Chad; about 1400 mi. long: A-36

Shark Bay, on w. shore of Western Australia, *map* A-372*a*

Sharkey, Jack (born 1902), American boxer, born Binghamton, N. Y.; world's heavyweight champion 1932: B-212

Sharks S-102–3, *pictures* F-69, F-72, S-103
eggs S-103, *picture* E-193
evolutionary position F-73, 67–8, *diagram* A-260
size S-102, F-72
skates and rays related F-67–8

Shark-sucker, or remora, a carnivorous fish (*Echeneidae*), widely distributed in warm seas. The first dorsal fin is modified to a sucking disc, with which it attaches itself to sharks, barracudas, and other large fish, as well as to boats.

Sharon (*shăr'ŏn*), Pa., manufacturing and railroad city on Shenango River, near Ohio line; pop. 25,622; coal and iron region.

Sharon, Plain of, fertile plain in w. Palestine along Mediterranean between Jaffa and Haifa F-33, S-361

Sharon, Rose of. *See in Index* Rose of Sharon

Sharp, Dallas Lore (1870–1929), American author and educator, born Haleyville, N. J.; Methodist Episcopal minister, 1895–99; professor English, Boston University; best known as writer of delightful essays and books on nature ('Wild Life Near Home').

Sharp, Rebecca ("Becky"), in Thackeray's 'Vanity Fair', clever, unscrupulous adventuress T-72

Sharp, William (1856–1905), Scottish author; wrote poetry and criticism under his own name; under name of "Fiona Macleod" (whose identity was kept secret until his death) did more famous work—largely tales of primitive Celtic world written in mystical, poetic prose and verse.

Sharp, a sign in musical notation M-318

"Sharper than a serpent's tooth" K-22

Sharp-shinned hawk H-245, 247, *pictures* B-123, H-246
nest, *picture* B-127

Shas'ta, Mount, peak near the northern boundary of California; 14,161 ft.: *map* C-28
changed by erosion V-332
why its cone is steep L-73

Shasta daisy D-5

Shasta Dam, California D-7, 8, C-29, *table* D-357

Shasta Indians, a group of small tribes of Indians forming a linguistic stock in n. California and s. Oregon.

Shatt-el-Arab (*shät-ĕl-ä-räb'*), name of lower course of Tigris and Euphrates rivers after junction 120 mi. from Persian Gulf: I-123
Tigris and Euphrates T-93, E-315

Shatter-proof glass G-104

Shaughnessy (*shqn'ĕs-ĭ*), **Thomas George, first Baron** (1853–1923), Canadian railroad executive, born Milwaukee, Wis.; began railroading with Milwaukee and St. Paul Railroad at age of 16; in 1882 entered employ of Canadian Pacific Railroad, became president 1898.

Shaving cream S-177

Shaw, Albert (born 1857) editor and writer on political science; born Shandon, Ohio; established 1891, American *Review of Reviews* ('Municipal Government in Great Britain'; 'Outlook of the Average Man').

Shaw, Anna Howard (1847–1919), American suffrage leader and minister (first woman ordained by Methodists), credited with large share in passage of U. S. suffrage amendment; born England; president 1904–15 National American Woman Suffrage Association: W-132

Shaw, George Bernard (born 1856), British dramatist, born Dublin, Ireland; fearless, witty, brilliant iconoclast ("My way of joking is to tell the truth"). Left school at 14, and at 20 went to London, where he spent many years in poverty, writing unsuccessful novels; became a socialist, active in the Fabian Society; later supported himself by music, drama, and art criticism. After 1892 he wrote chiefly dramas, which he used solely as a vehicle for his ideas, deliberately breaking usual rules; Nobel prize in literature 1925 ('Arms and the Man'; 'Man and Superman'; 'Candida'; 'The Doctor's Dilemma'; 'Saint Joan'; 'Pygmalion'; 'Back to Methuselah'; 'The Apple Cart'): D-96, *picture* E-288
Fabian Society S-181
place in English literature E-288

Shaw, Henry Wheeler. *See in Index* Billings, Josh

Shaw, Richard Norman (1831–1912), British architect, born Edinburgh; although well grounded in traditional forms, he developed a strikingly individual style and exerted strong influence; member of the Royal Academy.

Shaw, Robert Gould (1837–63), American soldier, born Boston; led Negro regiment in Civil War; killed in attack on Fort Wagner
Saint-Gaudens memorial S-7

ü=French *u*, German *ü*; ġem, ġo; thin, *th*en; ṅ=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); *ĸ*=German guttural *ch*

Key—cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wŏn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;

SOME FAMOUS SIEGES OF HISTORY

Name	Date	Duration	
Adrianople	1912–13	155 days	Turks besieged by Bulgarians. Fell.
Alcázar	1936	71 days	Fascists besieged by Loyalists. Raised.
Antioch	1097–98	9 months	Mohammedans besieged by Crusaders. Fell. Followed by a countersiege of the Crusaders by the Mohammedans. Raised.
Antwerp	1584–85	14 months	Belgians besieged by Spaniards under Prince of Parma. Fell.
	1830–32	15 months	Dutch garrison besieged by populace. Surrendered.
Arcot	1751	50 days	120 British and 200 Sepoys under Clive besieged by 150 French and 10,000 Sepoys. Raised.
Athens	431–421 B.C.	10 years	Besieged by Spartans. Intermittent sieges during crop season. Raised.
Candia	1667–69	2 years	Venetians besieged by Turks. Fell.
Carthage	148–146 B.C.	2 years	Carthaginians besieged by Romans. Fell.
Constantinople	673–677	5 years	Byzantines besieged by Saracens. Raised.
	717–18	1 year	Same as above.
	1453	54 days	Byzantines besieged by Turks. Fell.
Delhi	1857	131 days	Indian mutineers besieged by British. Fell.
Gibraltar	1779–81	3 yrs., 7 mos., 12 days	British garrison besieged by Spaniards. Raised.
Haarlem	1572–73	206 days	Dutch besieged by Spaniards under Don Frederic. Surrendered.
Jerusalem	70	5 months	Jews besieged by Roman legions under Titus. Fell.
	637	4 months	Mohammedans led by Omar invested Byzantine forces. Fell.
	1099	2 (?) months	Mohammedans besieged by Crusaders. Fell.
	1917	1 day	Turks besieged by British under Allenby. Fell.
Ladysmith	1899–1900	118 days	Boers besieged British. Relieved.
La Rochelle	1627	1 year	Richelieu besieged French Huguenots. Fell.
Leyden	1574	4 months	Spaniards besieged Dutch. Raised after Dutch cut dikes.
Lucknow	1857	149 days	British under Lawrence, later under Havelock, besieged by Indian mutineers. Relieved.
Madrid	1936–39	29 months	Loyalists besieged by Fascists. Surrendered.
Mantua	1796–97	8 months	Napoleon besieged Austrians. Fell.
Mafeking	1899–1900	217 days	Boers besieged British garrison under Baden-Powell. Relieved.
Orléans	1428–29	10 months	French besieged by English. Relieved by Joan of Arc.
Ostend	1601–04	3 years	Flemish besieged by Spanish. Surrendered.
Paris	1870–71	135 days	Besieged by Germans. Surrendered.
Petersburg	1864–65	290 days	Confederates besieged by Federals. Evacuated.
Plevna	1877	144 days	Turks besieged by Russians and Rumanians. Surrendered.
Port Arthur	1905	241 days	Russian garrison surrendered to Japanese.
Przemysl	1914–15	185 days	Russians besieged Austrians under Kusmanek. Surrendered.
Sardis	558 B.C.	14 days	Lydians besieged by Persians under Cyrus the Great. Fell.
Sebastopol	1856	335 days	Russians besieged by Allies. Fell.
Syracuse	214–212 B.C.	2 years	Besieged by Romans under Marcellus. Fell.
Torres Vedras	1810–11	7 months	British under Wellington held off advance of Napoleonic troops under Masséna. Raised.
Tyre	585–572 B.C.	13 years	Besieged by Nebuchadnezzar II. Raised.
	332 B.C.	7 months	Besieged by Alexander the Great. Fell.
Troy	13th or 12th cent. (?) B.C.	10 years	Greeks besieged Trojans. Fell.
Vicksburg	1862–63	186 days	Confederates invested by Federals under Grant. Fell.
Vienna	1683	58 days	Besieged by Turks. Relieved by John Sobieski. Raised

See also in Index Battles, table of

ü=French *u*, German *ü*; *ġ*em, *ġ*o; *th*in, *th*en; *ṅ*=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); ᴋ=German guttural *ch*

ü=French *u*, German *ü*; ġem, ġo; *th*in, *th*en; ṅ=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); ĸ=German guttural *ch*

ü=French *u*, German ü; ġem, ġo; *th*in, *th*en; ṅ=French nasal (Jeaṅ); *zh*=French *j* (*z* in azure); ḱ=German guttural *ch*

which it remained until 1842 when it was incorporated as a town; chartered as a city in 1871. The city is built on hills, and during Revolutionary times many fortifications were erected on the heights; tablet on Prospect Hill commemorates raising of first Colonial flag of thirteen stripes, Jan. 1, 1776. Somerville is principal meat-packing center of state; other important industries are iron and steel, printing, and furniture-making.

Somme (*sôm*) **River**, in n. France S-193, F-174
battles: 1st World War S-193, W-159, 162; 2d World War S-193
military cemetery U-225

Somnam'bulism, or sleepwalking S-163

Som'nus, in Roman mythology, god of sleep, corresponding to Greek Hypnos.

Sonata (*sō-nä'tȧ*), a musical composition of three or four individual movements, yet so related as to form a unified whole: M-312, P-213
Beethoven develops B-80

Song of Roland ('Chanson de Roland') R-126, S-303*i*, 303*o*

Song of Solomon, book of Old Testament, called also 'Song of Songs' and 'Canticles'; authorship ascribed to Solomon.

Songs
American Indian I-64–5
birds' B-125
folk F-132, 134–6
Foster F-164
Grieg G-178
list of song books M-317, H-313*m*
national N-24–7
poetry related to P-267
Schubert S-41

'Songs of Innocence', by William Blake B-155, L-160

Song sparrow S-238, *color plate* B-138

Song-thrush, or mavis T-88

Sonic depth-finder O-201

Sonneck, Oscar George Theodore (1873–1928), American musicologist and librarian, born Jersey City, N. J.; under his direction (1902–17) music section of Library of Congress became one of world's greatest; editor, *Musical Quarterly*.

Son'net, poem of 14 lines having a definite rhyme scheme P-270
Gilder's sonnet on P-270
Petrarch's, or Italian R-73, P-270
Shakespeare's P-270, S-98

'Sonnets from the Portuguese', by Elizabeth Barrett Browning B-250

Sonnino (*sôn-nē'nō*), **Sidney, Baron** (1847–1922), Italian statesman and financier; held many cabinet positions; foreign minister during 1st World War.

"Son of Heaven." *See* Jimmu Tenno

Sonoma, Calif., village 35 mi. n. of San Francisco; pop. 1158; Sonoma mission
"Bear Flag Republic" C-33

Sonora (*sō-nō'rä*), Mexico, state on Gulf of California bordering Arizona; 70,477 sq. mi.; pop. 315,000; cap. Hermosillo (pop. 20,000)
ejidos M-140
missions S-222

Sonoran Desert, Mexico U-182, M-134

Sonora River, Mexico, flows 300 mi. to Gulf of California: *map* M-133

Sons of Liberty, name given to the societies which sprang up in the various American colonies in opposition to the Stamp Tax, and later promoted separation from England; died out after Revolution
Golden Hill, battle of N-122
Stamp Act opposed by S-269: in New York N-134

Sons of the American Revolution P-89

Sons of Veterans, organization composed of descendants of Union soldiers in American Civil War.

"Soo." *See in Index* Sault Sainte Marie

Soochow', or **Suchow**, China, silk-manufacturing city on Grand Canal 55 mi. w. of Shanghai; founded 500 B.C.; pop. 260,000; almost destroyed by Taipings (1860): *map* C-212
pagoda, *picture* A-275

Sooner State, name for Oklahoma.

Soong, or **Sung**, name of famous Chinese family: T. V. Soong (born 1891) did notable work in Chinese government finance and was made foreign minister to the United States 1942; three sisters, educated in U.S. and active in Chinese political and social life, are: Ai-ling (born 1888), wife of H. H. Kung, one of China's financial and political leaders; Ch'ing-ling (born 1890), widow of Sun Yat-sen; and Mei-ling (born 1892), wife of Chiang Kai-shek: C-186

Soot, soft black deposit of the particles of carbon from smoke, due to imperfect combustion
industrial uses G-24

Soothsayer M-32

Sophia (*sō-fī'ȧ*) (1630–1714), electress of Hanover, heiress of English crown by Act of Settlement of 1701 (because nearest Protestant heir); mother of George I and ancestress of Hanover-Windsor line of British sovereigns.

Sophia, Bulgaria. *See in Index* Sofia

Sophia Dorothea (1666–1726), wife of George I of England G-52

Sophists (*sŏf'ists*), a group of teachers of rhetoric and practical philosophy in ancient Greece (4th and 5th centuries B.C.), of whom the most famous was Protagoras: E-169, 170
democracy rises out of ideas G-125
Socrates and S-188

Sophocles (*sŏf'ō-klēz*) (496–406 B.C.), Greek tragic dramatist G-172, D-92
Oedipus trilogy O-208

Sophomore C-301

Soprano (*sō-prä'nō*) voice
highest range of, *diagram* S-198

Soranzo (*sō-ränt'sō*) **Palace**, Venice, built in 15th century for Soranzo family, patrons of literature, in style of Doge's Palace; restored 19th century
interior, *picture* I-98

So'ra rail, a wading bird R-35

Sorata (*sō-rä'tä*), **Mount**, or **Illampu** (*ē-yäm'pọ*), peak in Bolivia; except Aconcagua, highest in South America (21,484 ft.): *map* S-208*b*

Sorbonne (*sôr-bŏn'*), college of University of Paris, seat of faculties of letters and sciences since 1808; founded by Robert de Sorbon 1257: U-260

Sorcery M-29–32, W-127–8. *See also in Index* Magic

'Sordel'lo', poem by Browning B-251

Sore'dia, of lichens L-122

Sorel', Agnes (1422?–50), favorite of King Charles VII of France; once reputed to have exercised powerful influence on French history, but now remembered chiefly for beauty and charm.

Sorel, Quebec, port on St. Lawrence and Richelieu rivers 45 mi. n.e. of Montreal; pop. 10,320; ships, wines, clothing, agricultural implements, foundry products: *map*, inset C-50*c*

Sorel cement C-128

Sorghum (*sôr'gŭm*) S-194
broom corn B-250
kafir K-1
kaoliang M-51, *picture* M-50
pioneers use P-221*e*

Sorghum pop, popcorn, *picture* B-277

Sorgo, or sweet sorghum S-194

Sori (*sō'rī*) (plural of "sorus"), spore cases of ferns S-75

Sorolla y Bastida (*sō-rōl'yä ē bä-stē'dä*), **Joaquin** (1863–1923), Spanish impressionist painter; excelled in marine compositions involving brilliant sunlight effects
'Hitching Oxen to the Boat', *picture* P-24

Soror'ities, college U-258. For list, *see in Index* Fraternities and sororities

Soro'sis, women's club W-131

Sorrel, wood, or ladies' sorrel, a low herb of the genus *Oxalis*
acid leaves N-39
explosive seed pods W-64, S-73

Sorrel-tree. *See in Index* Sourwood

Sorrento (*sôr-rĕn'tō*), or **Surrentum**, Italian resort on Bay of Naples; pop. of commune 10,000, of town 7000; ancient Surrentum, famous for wine; birthplace of Tasso.

S O S, wireless distress signal used at sea; adopted by International Radio-telegraphic Convention in 1912; the letters have no verbal significance, but are used because easily transmitted
automatic recorder, *picture* A-385
Republic sinks *Florida* R-27

SOS (Services of Supply), U.S. *See in Index* Services of Supply

Sosigenes (*sō-sĭj'ĕ-nēz*) (1st century B.C.), Greek mathematician and astronomer
calendar reform C-22

Sosnowiec (*sôs-nôv'yĕts*), Poland, city in Upper Silesian coal field, 40 mi. n.w. of Cracow; pop. 120,000; textile center: *map* E-326*d–e*

Sothern (*sŭth'ērn*), **Edward Askew** (1826–81), English actor; made part of 'Lord Dundreary' famous; father of E. H. Sothern.

Sothern, Edward Hugh (1859–1933), American actor, born New Orleans; in early years played romantic parts ('If I Were King'; 'The Three Musketeers'); later one of foremost Shakespearean actors (as Hamlet, Macbeth, Shylock, Petruchio); married (1911) Julia Marlowe: *picture* D-97

Sothic cycle, in the Egyptian calendar, a cycle of 1460 years of 365 days each. Supposedly each year started on the day when the star Sirius (Sothis) rose with the sun, but the interval of 365 days was about ¼th day short of being a full year. Hence every four years the New Year started another day too soon, and the seasons moved "backward" (from March to February, January, etc.) through the year. Once in 1460 years, however, New Year's Day comes correctly with the proper rising of Sirius. This 1460 year interval constitutes a Sothic cycle.

Sou (*sọ*), old French coin of various metals and values; name applied to former French 5-centime piece worth about a cent.

Soucek, Apollo, American aviator, *picture* A-71

Souchong (*sọ-chŏng'*) tea, *picture* T-22

Soudan. *See in Index* Sudan

Soul. *See also in Index* Transmigration of the Soul
Egyptian beliefs M-301
Greek beliefs H-194, C-414

Soulé (*sọ-lā'*), **Pierre** (1802–70), American political leader, born France; U.S. senator from Louisi-

Key—cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fērn, thêre; īce, bĭt; rōw, wȯn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;

ü=French *u*, German *ü*; ġem, ġo; thin, then; ṅ=French nasal (Jeaṅ); zh=French *j* (z in azure); ᴋ=German guttural *ch*

KINGS OF SPAIN

	HOUSE OF ARAGON
1479–1504	Ferdinand and Isabella (Union of Castile and Aragon)
1504–1516	Ferdinand, King of all Spain
	HOUSE OF HAPSBURG
1516–1556	Charles I
1556–1598	Philip II
1598–1621	Philip III
1621–1665	Philip IV
1665–1700	Charles II
	HOUSE OF BOURBON
1700–1746	Philip V
1746–1759	Ferdinand VI
1759–1788	Charles III
1788–1808	Charles IV
1808	Ferdinand VII
	HOUSE OF BONAPARTE
1808–1813	Joseph Bonaparte
	BOURBON RESTORATION
1814–1833	Ferdinand VII
1833–1868	Isabella II
[1868–1870	Provisional Government]
	HOUSE OF SAVOY
1870–1873	Amadeo I
[1873–1874	First Republic]
	HOUSE OF BOURBON
1874–1885	Alfonso XII
1885–1886	Maria-de-las-Mercedes
1886–1931	Alfonso XIII
[1931	Second Republic established]

Key—cāpe, ăt, fär, fȧst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wŏn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;

Key—cāpe, ăt, fär, făst, whạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wọn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;

ü=French *u*, German *ü*; ġem, ġo; thin, then; ṅ=French nasal (Jeaṅ); zh=French *j* (z in azure); ĸ=German guttural *ch*

Key—cāpe, ăt, fär, fȧst, what, fall; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, wŏn, fôr, nŏt, dọ; cūre, bŭt, rụde, fụll, bûrn;

SELECTIONS FOR THE NATIONAL STATUARY HALL

State	Name	Date	Activity	Date Statue Accepted
Alabama	Joseph Wheeler	1836–1906	General in the Confederate army	1925
	Jabez Lamar Monroe Curry	1825–1903	United States minister to Spain	1907
Arizona	John Campbell Greenway	1872–1926	General manager, Calumet and Arizona mining company, Bisbee	1930
Arkansas	Uriah M. Rose	1834–1913	Lawyer and political leader	1917
	James P. Clarke	1854–1916	United States senator	1921
California	Junipero Serra	1713–84	Franciscan missionary	....
	Thomas Starr King	1824–64	Orator. Helped keep California in Union	....
Connecticut	Roger Sherman	1721–93	On committee to draft Declaration of Independence	1872
	Jonathan Trumbull	1710–85	First state governor of Connecticut	1872
Delaware	Caesar Rodney	1728–84	Signer of Declaration of Independence	....
	John M. Clayton	1796–1856	United States senator	....
Florida	John W. Gorrie	1803–55	Invented ice-making machine	1914
	Edmund Kirby Smith	1824–93	General in Confederate army	1918
Georgia	Alexander Hamilton Stephens	1812–83	Vice-president of Confederacy	1927
	Crawford W. Long	1815–78	Pioneer in use of ether	1926
Idaho	George Laird Shoup	1836–1904	Last territorial and first state governor	1909–10
Illinois	Frances Elizabeth Willard	1839–98	Temperance leader	1905
	James Shields	1810–79	General in Civil War	1893
Indiana	Lewis (Lew) Wallace	1827–1905	General, United States Army. Author	1909–10
	Oliver Perry Morton	1823–77	Civil War governor of Indiana	1899
Iowa	Samuel Jordan Kirkwood	1813–94	U. S. senator and secretary of interior	1913
	James Harlan	1820–99	U. S. senator and secretary of interior	1909
Kansas	John James Ingalls	1833–1900	United States senator	1904–05
	George Washington Glick	1827–1911	Governor of Kansas	1914
Kentucky	Henry Clay	1777–1852	American political leader	1929
	Ephraim McDowell	1771–1830	American surgeon	1929
	Hannibal Hamlin	1809–91	Vice-president of the United States	1934
Louisiana	Huey Pierce Long	1893–1935	United States senator	1941
Maine	William King	1768–1852	First governor of Maine	1878
Maryland	Charles Carroll	1737–1832	Signer of Declaration of Independence	1902–03
	John Hanson	1715–83	President of Continental Congress	1902–03
Massachusetts	Samuel Adams	1722–1803	Revolutionary patriot	1873
	John Winthrop	1588–1649	First colonial governor	1875
Michigan	Lewis Cass	1782–1866	Cabinet officer under Van Buren	1889
	Zachariah Chandler	1813–79	United States senator	1913
Minnesota	Henry Mower Rice	1816–94	First United States senator from Minn.	1916
Mississippi	Jefferson Davis	1809–89	President of Confederacy	1931
	James Zachariah George	1826–97	United States senator	1931
Missouri	Thomas Hart Benton	1782–1858	United States senator	1899
	Francis P. Blair, Jr.	1821–75	General in Civil War	1899
Nebraska	William Jennings Bryan	1860–1925	Orator and statesman	1937
	Julius Sterling Morton	1832–1902	Journalist and statesman	1937
New Hampshire	Daniel Webster	1782–1852	Statesman and orator	1894
	John Stark	1728–1822	Revolutionary soldier	1894
New Jersey	Richard Stockton	1730–81	Signer of Declaration of Independence	1888
	Philip Kearny	1815–62	General in Civil War	1888
New York	Robert R. Livingston	1746–1813	On committee to draft the Declaration of Independence	1874
	George Clinton	1739–1812	First state governor of New York	1873
North Carolina	Zebulon Baird Vance	1830–94	Governor and United States senator	1916
	Charles Brantley Aycock	1859–1912	Governor and educator	1932
Ohio	William Allen	1803–79	Governor of Ohio	1888
	James Abram Garfield	1831–81	President of the United States	1886
Oklahoma	Sequoyah	1770?–1842	Inventor of Cherokee alphabet	1917
	Will Rogers	1879–1935	Humorist and philosopher	1939
Pennsylvania	Robert Fulton	1765–1815	Built first successful steamboat	1889
	John Peter Gabriel Muhlenberg	1746–1807	Officer in Revolutionary War	1889
Rhode Island	Roger Williams	1604?–84	Founder of Rhode Island	1872
	Nathanael Greene	1742–86	General in Revolutionary War	1870
South Carolina	John Caldwell Calhoun	1782–1850	American statesman	1909–10
	Wade Hampton	1818–1902	Confederate general	1929
South Dakota	William Henry Harrison Beadle	1838–1915	Pioneer and educator	1938
Tennessee	John Sevier	1745–1815	First governor of Tennessee	1931
	Andrew Jackson	1767–1845	President of the United States	1928
Texas	Samuel Houston	1793–1863	President of Texas Republic	1904
	Stephen Fuller Austin	1793–1836	Founder of Texas	1904
Vermont	Ethan Allen	1737–89	Hero of Ticonderoga	1875
	Jacob Collamer	1791–1865	United States senator	1881
Virginia	Robert E. Lee	1807–70	Confederate general	1908
	George Washington	1732–99	First president of United States	1908
West Virginia	Francis Harrison Pierpont	1814–99	Governor of West Virginia	1903–13
	John Edward Kenna	1848–93	United States senator	1901
Wisconsin	Robert Marion La Follette	1855–1925	American political leader	1929
	Jacques Marquette	1637–75	Discovered Mississippi River	1896–1904

Statues listed first under each state are located in National Statuary Hall. Those listed second are in other parts of the Capitol

ü=French *u*, German *ü*; ġem, ġo; *th*in, *th*en; ṅ=French nasal (Jeaṅ); zh=French *j* (*z* in azure); ᴋ=German guttural *ch*

SUPREME COURT OF THE UNITED STATES

	Born	Year of Appointment	Appointed by
Harlan Fiske Stone (Chief Justice)	1872	1925 (1941)	Calvin Coolidge (Franklin D. Roosevelt)
Owen Josephus Roberts	1875	1930	Herbert Hoover
Hugo La Fayette Black	1886	1937	Franklin D. Roosevelt
Stanley Forman Reed	1884	1938	Franklin D. Roosevelt
Felix Frankfurter	1882	1939	Franklin D. Roosevelt
William Orville Douglas	1898	1939	Franklin D. Roosevelt
Frank Murphy	1893	1940	Franklin D. Roosevelt
Robert Houghwout Jackson	1892	1941	Franklin D. Roosevelt
W. B. Rutledge, Jr.	1894	1943	Franklin D. Roosevelt

CHIEF JUSTICES OF THE UNITED STATES

John Jay	1789–95
John Rutledge	1795
Oliver Ellsworth	1796–99
John Marshall	1801–35
Roger B. Taney	1836–64
Salmon P. Chase	1864–73
Morrison R. Waite	1874–88
Melville W. Fuller	1888–1910
Edward D. White	1910–21
William H. Taft	1921–30
Charles Evans Hughes	1930–41
Harlan Fiske Stone	1941-

peninsula; 173,105 sq. mi.; pop. 6,250,000; cap. Stockholm: S-335–40, *maps* N-173, E-326*c*, *d–e*, *f*, *Outline* S-340–1. A list of the rulers of Sweden will be found in the *table* in the next column
agriculture S-338, 335: coöperative A-58; school gardens S-41
bibliography S-341
bread baking, *picture* B-228
Christmas customs C-226–7, 229*a*
cities S-336, 337, list S-335. *See also in Index* names of cities
climate S-335–6: rainfall, *map* E-318*a*
commerce S-337: exports and imports, *table* C-480
coöperative societies C-355*b*, 356
costume, *pictures* P-254, F-134, S-336
customs: Christmas C-229*a*; folk-dances F-135, *pictures* F-134, S-338
education S-338: illiteracy P-304*d*; Stockholm S-290; vocational, *picture* V-323
emigration to U. S. I-22, 23
fisheries S-336, 338
flag F-97, *color plate* F-89
games P-248–9, 250, 254, 255
glass engraving, *picture* G-104
history S-338–40, *Outline* S-340–1
Northmen N-166–70
Finland conquered F-44
Union of Kalmar D-53
printing introduced P-347
Gustavus Adolphus and Thirty Years' War G-189–90, T-80–1
settlements in North America: Delaware D-41–2, *picture* D-40*a*; New Jersey N-92
Charles XII and Great Northern War C-154, P-143
Seven Years' War S-84
"Hats and Caps" H-236
Napoleonic Wars N-8, 9
union with Norway dissolved N-178
holidays: Gustavus Adolphus Day H-323; Midsummer's Day S-289, S-335
language and literature S-38, S-303*f*, *m–n*. *See also in Index* Scandinavian languages; Scandinavian literature
lumber and timber S-338
manufactures S-338, S-290
merchant marine S-338, 337: tonnage S-129
minerals S-338: iron S-338, 337–8
national song N-26
natural features S-335, 336, 337–8
people S-335–8, 338: Lapps L-64, S-337
population density, *map* E-318*a*
postal service, *picture* P-318
products, list S-335
square coin, 17th century, *picture* M-220*a*
winter sports S-335–6; skiing W-116
woman suffrage W-133
Swedenborg (*swē'dĕn-bôrg*), **Emanuel** (1688–1772), Swedish scientist, philosopher, and religious mystic, theological writings, expounding Bible and universe, form basis of doctrine of the Churches of the New Jerusalem, called Swedenborgian (membership in U. S. about 6000).
Swedish clover C-282
Swedish in America
early colonies: in Delaware D-41–2, W-105, *picture* D-40*a*; New Jersey N-92; Pennsylvania P-116
later immigration I-22, 23
Swedish language and literature S-36. *See also in Index* Scandinavian languages; Scandinavian literature
Swedish mile, *table* W-87
"Swedish nightingale." *See in Index* Lind, Jenny
Swedish rye crisp B-229
Swedish turnip, or rutabaga C-2
when and how to plant G-13
Swedish weaving dance F-135
Sweet, Henry (1845–1912), English philologist, born London; known as founder of modern phonetics ('New English Grammar'; 'History of Language').
Sweet alys'sum. *See in Index* Alyssum
Sweetbay magnolia M-35
Sweet birch B-119
Sweetbread, the thymus gland or pancreas of an animal when used as food.
Sweet Briar College, at Sweet Briar, Va.; established 1901; women; nonsectarian; arts and science.
Sweetbrier, a rose R-158
Sweet buckeye, or yellow buckeye B-257
Sweet Chalybeate (*kalĭb'ē-ăt*) **Springs,** Va., village 30 mi. n.w. of Roanoke; fashionable summer resort; mineral springs.

KINGS OF SWEDEN (FROM 1523)

HOUSE OF VASA	
1523–1560	Gustavus I, Vasa
1560–1569	Eric XIV
1569–1592	John III
1592–1604	Sigismund III
1604–1611	Charles IX
1611–1632	Gustavus II Adolphus
1632–1654	Christina
HOUSE OF PFALTZ	
1654–1660	Charles X
1660–1697	Charles XI
1697–1718	Charles XII
1718–1720	Ulrica Eleanora
HOUSE OF HESSE	
1720–1751	Frederick I
HOUSE OF HOLSTEIN-GOTTORP	
1751–1771	Adolphus Frederick
1771–1792	Gustavus III
1792–1809	Gustavus IV
1809–1818	Charles XIII
HOUSE OF PONTE CORVO	
1818–1844	Charles XIV (John)
1844–1859	Oscar I
1859–1872	Charles XV
1872–1907	Oscar II
1907–	Gustavus V

Sweet cicely. *See in Index* Cicely, sweet
Sweet clover C-281, C-282
Sweet coltsfoot. *See in Index* Winter heliotrope
Sweet corn C-367, 368, 389
when and how to plant G-13
Sweet flag. *See in Index* Calamus
Sweet gale family, or Myricaceae (*mir-ĭ-kā'sē-ē*), a family of shrubs and trees, native to temperate regions, including the California wax-myrtle or bayberry, bayberry, and sweet gale.
Sweet gum, *See in Index* Red gum
Sweet laurel, bay laurel, or bay tree L-72
"Sweet" music, a term invented to describe that form of jazz music in which the improvising is less complex than in so-called "hot" jazz music, and in which the brass instruments are often subordinated to the strings.
Sweet pea S-341
when and how to plant G-7
Sweet potato, tropical vine, grown for edible root S-341
products from P-245*c*
when and how to plant G-13
yam S-341
Sweet-potato squash S-265
Sweet rocket, or dame's violet, a tall perennial garden plant (*Hesperis matronalis*) of the mustard family with pointed lance-shaped leaves and purple or white flowers, fragrant at night.
Sweet sultan, a plant of the genus *Centaurea*
how to plant G-10
Sweetwater, Tex., agricultural center 38 mi. w. of Abilene; pop. 10,867; cotton products, meat packing, oil, gypsum: *map* T-58
Sweetwater River, crosses Rocky Mts. in s. center of Wyoming and enters n. fork of Platte River; 180 mi. long: *map* W-194
gold discovered W-196
Sweet-william, a pink P-221
directions for planting G-10
Sweet-william catchfly. *See in Index* Silene
Swell organ, manual of organ O-250
Sweyn (*swān*) **I, Forkbeard** (died 1014), king of Denmark 991–1014; ravaged England yearly after massacre of Danes in England in 1002; father of Canute the Great: C-79
Swift, Gustavus Franklin (1839–1903), American meat packer, born near Sandwich, Mass.; established plant in Chicago 1875; pioneer in production of packing-house by-products such as oleomargarine, soap, glue, and preparations used in medicine.
Swift, Jonathan (1667–1745), English satirist S-342–5
bibliography S-344–5
'Gulliver's Travels' S-343–4, 342
satire on talking C-347*a–b*
will W-98
Swift, a lizard L-172
Swift, a swallow-like bird S-333, *picture* S-333, *color plate* B-136
Swift Current, Saskatchewan, Canada, town on Swift Current Creek, 153 mi. w. of Regina; pop. 5074; farm and trade center: *map* C-50*b*
Swim'merets, small paddle-like limbs on segments of abdomen of some crustaceans
crawfish C-392, *picture* C-391
lobster L-175, 178
Swimming S-345–6, *pictures* S-347
accident prevention S-2*i–j*
bibliography H-313*c*
camp precautions C-47*b*
diving S-345–6, *pictures* S-347, G-94
life saving S-348
strokes S-345, *pictures* S-347
water polo P-297
Swimming crab, *picture* C-389
Swin'burne, Algernon Charles (1837–1909), English poet S-346, 348
bibliography S-348
buried on Isle of Wight W-97
poetry characterized E-287
Swin'don, England, market and railroad town 72 mi. w. of London; pop. 62,000; large locomotive and car works; old town is the "Svindune" of Domesday: *map* E-270*a*
Swine. *See in Index* Hog
'Swing Low, Sweet Chariot', a Negro spiritual F-135
Swing music, a development of jazz, characterized by elaborate, spontaneous improvisation on melodies, harmonies, and rhythms.
Swings, in cattle herding C-111
Swinnerton, Frank A. (born 1884), English novelist and critic, born London; self-educated; critic on Manchester *Guardian*; novels show subtle psychological analysis, skill in rendering atmosphere ('Nocturne'; 'Coquette'; 'Young Felix').
Swinton, William (1833–92), American educator, born Salton; Scotland; correspondent for New York *Times* during Civil War; professor English, University of California; his spelling, geography, and history